GRAPHIC SCIENCE

THE MAGAZINE FOR DRAFTSMEN

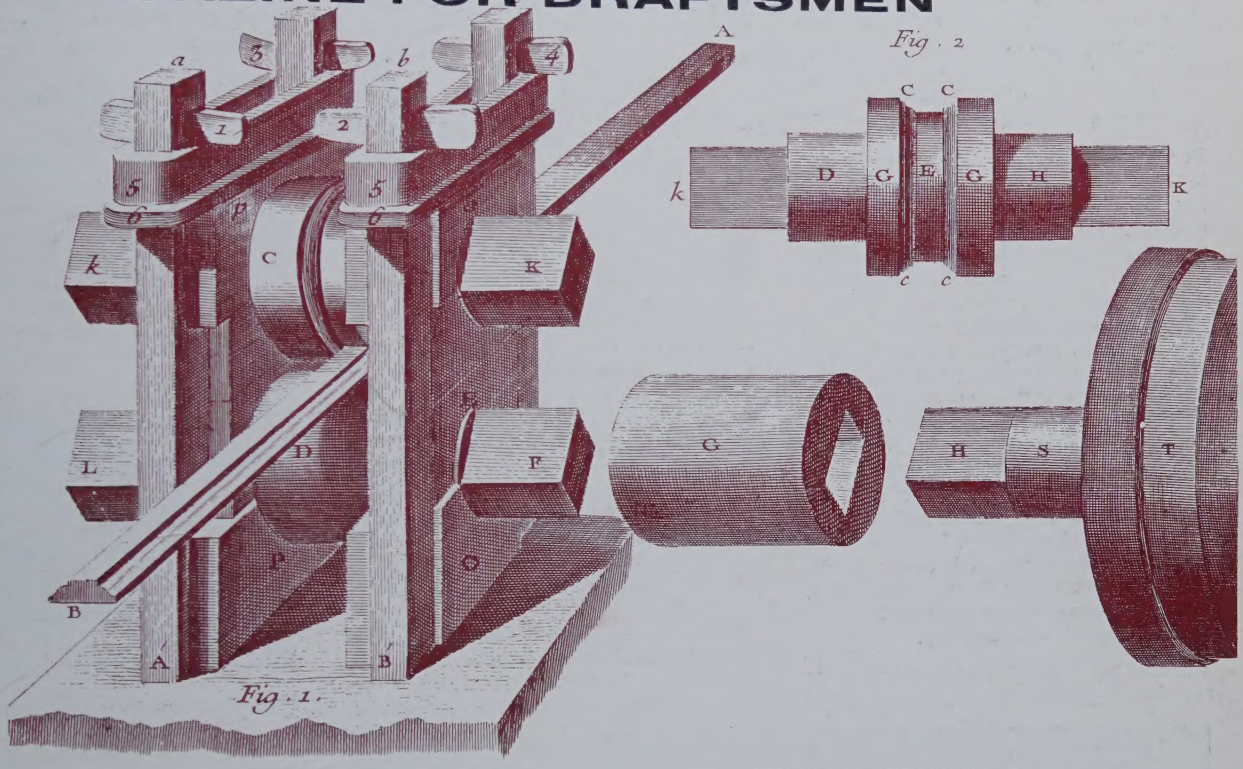

Fig. 1.

Fig. 2.

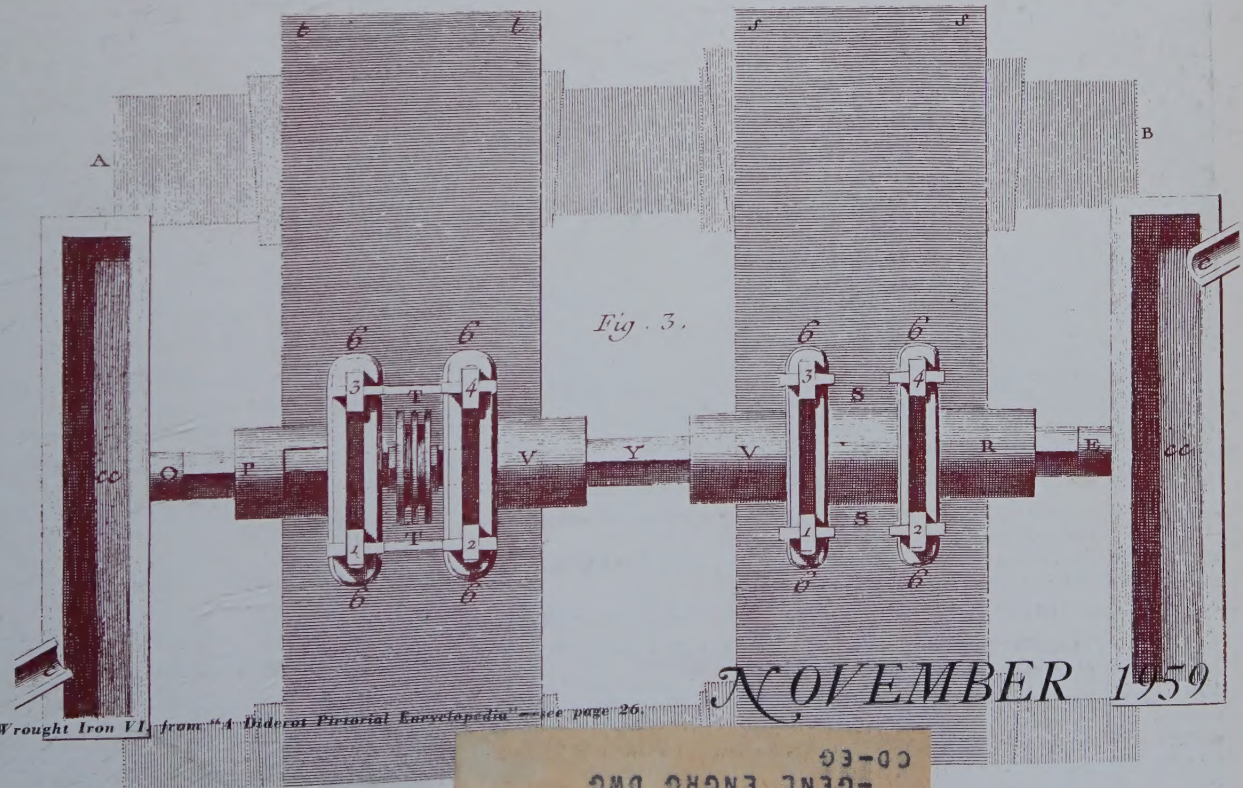

Fig. 3.

NOVEMBER 1959

Plate 100 Wrought Iron VI, from "A Diderot Pictorial Encyclopedia" — see page 26

Some Ideas

for your file of practical information on drafting and reproduction from

KEUFFEL & ESSER CO.

Frankly, we hope you're a fusspot. If you are fussy about the way you work, and proud of it, we think you'll enjoy knowing about three K&E items which reduce the effort required to get pin-neat results. Our first suggestion is . . .

A Better "Mattress" for Your Drawing Board

For effortless drafting, a good board cover is about as important as a good mattress is for sound sleep. Which is why so many draftsmen swear by LAMINENE® (N 70), the only *laminated* board cover material made. An exclusive, patented K&E process gives LAMINENE several very practical advantages over plastic coated papers. You can stretch it, drumhead-tight, over your board. All you do is wet the back, then secure the ends by taping or stapling to the underside of the board. After drying, LAMINENE grips the board as if cemented—there's no rippling, no stretching with the weather, no slack to take up. Its "drafting feel" is perfect: just the right balance of firmness and resiliency. LAMINENE'S non-glare surface makes it easier on the eyes, too, even under fluorescent lighting. You can expect to leave the board feeling fresher, even after a long day.

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LAMINENE is available in White or Eye-Ease Green; plain or with 4 x 4, 8 x 8 and 10 x 10 grids to the inch, which act as permanent two-way tracing guides. A free sample can be yours in a few days if you write us today. If you've never tried a laminated board cover, we promise you a new experience!

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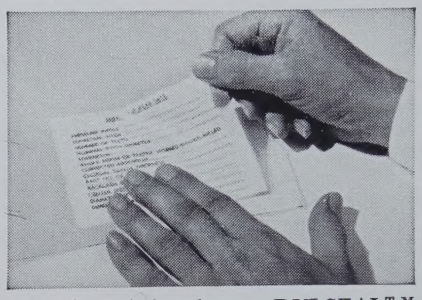

—clearly and sharply—on DULSEAL[T.M.] (74). This tissue-thin film has a delayed-action adhesive on the back, and a dull-finish face for easy writing or printing. Stickers made of Dulseal can be firmly positioned—and re-positioned hours later, just as firmly. The adhesive takes 24 hours to set. Once it does set, a permanent bond is formed with the paper or cloth beneath. Dulseal is chemically stable, and the adhesive will not bleed, even in hot copying machines.

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3 To Keep Clean

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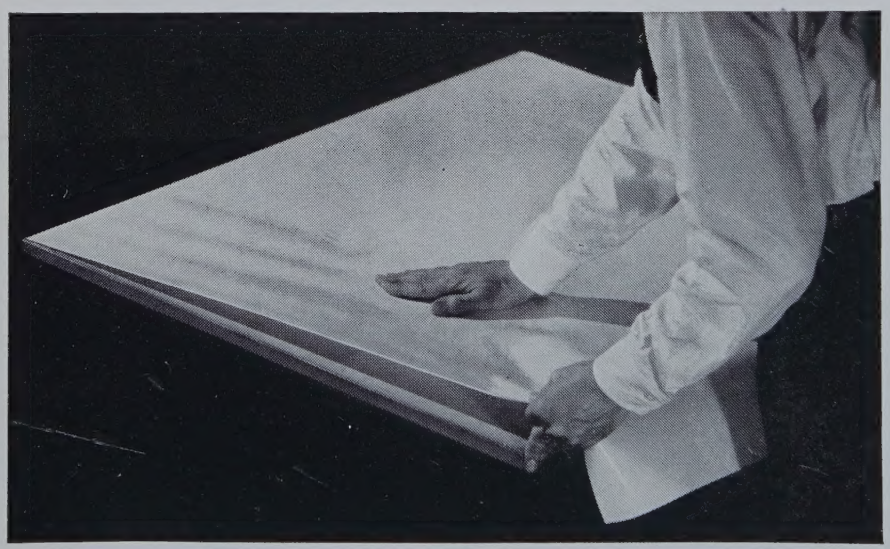
For this purpose, K&E supplies cleaning particles put up in three different ways. We think the new plastic squeeze-bottle (3036C) is the handiest of all. The shaker-top can (3036) has also been a drafting-room favorite for some time. And, for double-duty cleaning, we suggest the ABC Dry-Clean Pad[T.M.] (3037), which holds slightly coarser granules that sift through soft mesh. The ABC Pad also comes in handy for wiping a complete tracing after it is finished, or for preparing certain surfaces for ink work. Or for an overall pre-cleaning, since the best way to insure clean tracings is never to let soil build up.

The proverbial ounce of prevention is worth the traditional pound of cure!

These K&E products, and others that can make life easier for you, are available from your nearby K&E dealer. See him soon . . . or send us the coupon below for further information and samples.



KEUFFEL & ESSER CO., Dept. GS-11, Hoboken, N. J.

Please send me samples of LAMINENE® Drawing Board Surface Material, and DULSEAL[T.M.] Tape . . . plus information on K&E cleaning powders.

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2002

GRAPHIC SCIENCE
THE MAGAZINE FOR DRAFTSMEN

NOVEMBER 1959

VOLUME I NUMBER 2

ARTICLES

DEPARTMENTS

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Letters

Sirs:

Thank you for your historic issue. It is the starting gun of a crusade for recognition of the underprivileged which will rank with the institution of Father's Day.

Who knows? You may deter many a timorous Draftsman 1/c from an attempt to leap the awful chasm to Engineer, j.g. Too many excellent draftsmen have become lousy engineers in an effort to attain stature and make more money.

I wish to suggest an assignment for one of your more literate and vocal staff personnel:

We pay national lip service to "ideas." Nobody really wants them badly enough to pay for them, but it sounds good. Nevertheless, ideas play a part in the working day of any good workman in technical activity.

How is an idea born to one of these people? Yes, it is hazily conceived in his subconscious, but it must make the transition to something visual as a first step in making it a reality.

This Man with an Idea speaks to a Friend: "Say, I've got an idea!"

"No kiddin?"

"Yeah! It would work something like this . . . (long silence) . . . Of course, I'm no artist, but . . ."

Here is where this idea, good or bad, is almost nipped in the bud. This bozo, who may be a top notch draftsman, engineer, mechanic, or v.p., takes a pencil in his hand and makes like a bumblehead.

Through all of the ensuing perspiration, and apology, he attempts to make what I call an Engineering Sketch. If anybody can make it out, it is a miracle. His Friend starts to nod and says something like, "Yeah, looks like a great idea."

The first trial of this flight of fancy is a flop.

In my opinion, every course having to do with drafting, engineering, and related activity should *start* with a comprehensive course in the technique of the Engineering Sketch. It is the most useful tool in the selling of a technical idea. No doubt this is recognized in certain quarters, but no one in my acquaintance has run across any emphasis on this point.

Take this ball and run with it, Gentlemen, and Gentle Ladies. I would myself, but as I say, I'm no artist. . . .

W. E. Stageberg
Bemis Bro. Bag Co.
Terre Haute Ind.

Sirs:

Volume I, Number I, of Graphic Science reached my desk early this morning. I offer my profound thanks and congratulations for giving birth to a publication which has been sorely needed, lo, these many decades.

As a practicing Industrial Designer active in the graphics field, I would appreciate being added to your free mailing list.

Also, I am very much interested in writing for your publication. . . .

Raymond T. Cassidy, IDI
Bridgeport, Conn.

Sirs:

On page 30, the 2nd edition of *Technical Drawing* is listed. It would have been better to list the 4th edition, 1958. I enjoyed the article by Mrs. Thompson.

H. C. Spencer
Illinois Institute of Technology
Chicago, Illinois

Sirs:

(It would have been better to) . . . express definite acceptable indexes for appraising the drafting operation. The initial article appears vague to me.

Harry A. Markle, Jr.
Fuller Company
Catasauqua, Penna.

Sirs:

Your first issue was excellent! We in the drafting phase of engineering have certainly been "the lost generation." Your magazine should help us in the educational area to keep abreast of latest developments.

Loring W. Hulick
Orange County Community College
Middletown, New York

Sirs:

This magazine is a very good idea, and I hope it succeeds. I am definitely interested in writing for it. I am particularly interested in a closer tie-in between descriptive geometry and technical illustration. I have found that most illustrators are trained in commercial art, and do not know the descriptive geometry necessary to draw in complicated details.

H. W. Blakeslee
Drexel Institute of Technology
Philadelphia 4, Pa.

Sirs:

I'm so glad you've come into existence as a magazine. I felt the need of such a publication for a long time, and you may be assured of a warm reception at my drawing board! May I please receive Volume 1, Number 1 for my very own, to start my files? Thanks a lot . . . . *for being!*

(Mrs.) Lois O'Brien
Lear, Inc.
Santa Monica, Calif.

Sirs:

Congratulations on having put the first issue of Graphic Science into orbit. My first impression is that if future issues are as informative as that of October '59, this publication will go a long way toward filling a much needed communication medium in the drafting field.

As a suggestion, it might be advisable in planning for future issues to consider the inclusion of articles bearon the subjects such as:

1. The pros and cons for the adoption of the Metric System in the States.
2. Photography as a drafting tool.
3. The preparation of drawings for numerically tape - controlled machine tools.
4. Government drafting requirements—standards and trends.
5. True-position dimensioning.
6. Geometric tolerances.

I want to wish you every success with Graphic Science. . . .

C. H. Bayer
General Electric Company
Schenectady, New York

(*Continued on page* 34)

Now... a KOH-I-NOOR *RAPIDOGRAPH* "TECHNICAL" FOUNTAIN PEN

with 7 interchangeable drawing point widths.

Each individual drawing point section complete with airtight refillable ink cartridge.

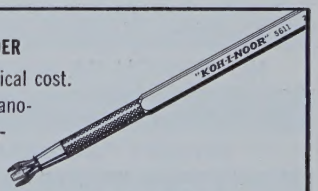
MODEL No. 3065: This new model, like the standard Rapidograph, is non-clogging when used with either India or regular writing ink for ruling, lettering, tracing or writing. Designed to meet the special needs of the professional who requires frequent change of the seven available "Color-Coded" line widths in desk and board work. The interchange of point sections is accomplished quickly, and with complete cleanliness. The set box serves as a handy permanent container for the holder and set of 7 point sections.

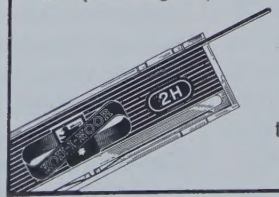
RAPIDOGRAPH Non clogging "TECHNICAL" FOUNTAIN PEN

MODEL NO. 3060: The regular Koh-I-Noor Rapidograph "Technical" Fountain Pen, with pocket clip, is a standard drafting room tool. Self-contained automatic filling system. Made in the same 7 precision line widths.

No. 5611 KOH-I-NOOR LEAD HOLDER

High quality, all metal, at economical cost. Attractive lightweight red barrel, anodized grey knurled finger grip; non-slip clutch holds 10 degrees of lead (2B through 6H).





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A flip of the thumb feeds lead to Lead Holder cleanly, without need to touch the lead. Available in 17 degrees of hardness.

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KOH-I-NOOR PENCIL Co., Inc. BLOOMSBURY 16, NEW JERSEY

Notes & Comment

Glass House Policy

In Holyoke, Massachusetts, 500 persons are being put through the rigors of a three-day workshop as we go to press. They're attending the 16th Seminar Workshop in Visual Communication sponsored twice each year by Tecnifax Corporation. The current session is October 20, 21, and 22, too late for coverage in this issue. Next month, look for a complete report.

About the glass house: Tecnifax, producer of technical facsimile materials, supplies *gratis* to interested persons (who apply soon enough) this three day sequence of workshops which are designed to give practical, first-hand experience in the utilization of diazotype process, photography, Xerography, and other related actinic reproduction techniques. The seminar —based on a company philosophy that other communications methods are complementary, rather than competitive — gives the attendant accurate fundamental information concerning the company and its operations, and what it is trying to do. In the spirit of this "glass house philosophy" the seminar includes information not only about Tecnifax products, but several techniques of visual communication which are not included in their line.

Speed—And Then Some

An electronic process for translating computer language has been adapted for use as a facsimile system for high speed scanning and direct reproduction or transmission of graphic material — such as original drawings, or microfilm. This was recently announced by A. B. Dick Company, Chicago. According to company spokesmen, Videograph equipment presently under manufacture is useful for the reproduction of engineering drawings (or other documents) where the reproduction is an 8½ by 11 sheet. On the input side of the system, the firm has a mechanical optical scanner which will accept 8½ by 11 source documents. In conjunction with this scanner, A. B. Dick has been cooperatively working with Bell & Howell Company on an attachment which will read 35 mm. microfilm records of engineering drawings, as well as aperture cards, although this is still in the developmental stages. The Videograph process is capable of producing facsimilies . . . and reportedly at speeds in the order of ten times faster than any other known equipment.

Microreproduction Equipment

The second edition of a 438 page paperbound Guide to Microreproduction Equipment published early this year by the National Microfilm Association is being exhausted, according to Dr. Vernon Tate, The Association's Executive Secretary. Edited by Hubbard W. Ballou, Director of Photographic Services, Columbia University Libraries, the reference work includes photographs and specifications of cameras, readers, hand viewers, processors, contact printers, enlargers, accessories, miscellaneous items and film.

U.S. Versus European Drafting Rooms

Perhaps the final tribute to Architects Sherwood, Mills and Smith in their design of the drafting areas at Dorr - Oliver's International Headquarters building at Stamford, Connecticut (see pp. 10-12), came from a designer at D-O. A senior man, with considerable experience in European design operations, he volunteered the comment that for the first time in his experience in the U.S., the spacious, well-lighted room in which he stood compared favorably with drafting rooms in Europe.

Blue Skies

Half a dozen companies are working on a drawing device which can be run by punched tape, put design information obtained from computers directly on paper. . . . Being perfected: a system to record, and reproduce drawings at high speeds, on video tape.

Photodrafting Techniques

A primer on the use of photographic methods in conjunction with drafting for efficient transmittal of needed engineering information

by George C. Schmidt

THE APPLICATION OF PHOTOGRAPHY to engineering had its beginning back sometime in the early thirties when the technique of making photo-tracings was introduced, using the still-popular contact printing frame.

This device made it possible to make film or paper negatives from existing drawings, and to delete any unwanted material from any part of the negative simply by opaquing the areas which would not apply to the new design. From these negatives it was then possible to make second originals on sensitized translucent paper or cloth. Using these reproductions the draftsman would then proceed to complete the design by filling in the areas which had been deleted for purposes of the new design.

A new drawing was thereby created without the need of tracing repetitive work. This was an early step taken to reduce drafting time, expedite output of the drafting room and relieve highly skilled engineering and drafting talent from doing repetitious work.

The intervening years have seen many improvements in print and drawing reproduction. In addition to the perfection of high speed blueprinting equipment, considerable improvement became evident in the diazo (ammonia) process, photocopying, offset printing and other reproduction methods to simplify and expedite the duplication of engineering drawings. The process camera also came into its own in helping to advance photography as a useful tool in engineering design and drafting, for it provided a means of changing the scale of any reproduction.

This technique, using the camera, coupled with the variations obtainable by way of the contact printing frame, made possible the enlarging or reducing of drawings, combining parts or sections of different drawings and splitting up and rearranging parts or sections of a drawing into any reworked second original. A given design or detail could even be reversed to obtain opposite hand arrangement simply by making a direct reading negative and deleting all figures and lettering.

More recently the increased use of microfilming in engineering made possible the utilization of the microfilm camera as a means of enlarging, reducing and changing scale at will from any microfilm image. The microfilm frame can be projected onto silver-sensitized paper or cloth, to any given size or scale desired, areas not wanted can be masked out, and second originals obtained in a matter of minutes.

All this raises the thought that if a drawing can be made up from parts of other drawings using negatives, then a drawing can be made into a photodrawing in the same manner, using selected photographs. For ease of reading and interpretation, however, it is preferred to use positive prints of photos, rather than the negatives, but on film or translucent paper.

What Is Photodrafting?

PHOTODRAWING, or photodrafting as it is sometimes called, is the technique of making and using photographs to convey dimension, position, identification and spatial-relationship information in the same manner as engineering drawings.

In general, the method consists of making photographs and reproducing them with descriptive and dimensional data on a translucent material suitable for use as an intermediate for

making blueprints or direct process prints (ammonia process).

The advantages of photodrawings are numerous as well as significant in their savings of time and money in preparation, and in their promotion of quick, easy understanding by the ultimate user. Photographic methods can be applied to assist the engineer and draftsman whenever it appears possible to expedite the design, improve the clarity of any communication, or relieve highly skilled engineering and drafting talent from doing repetitive work.

The most important use of photography in engineering is in the reconstruction or rehabilitation of existing installations, especially when so-called "as-built" drawings have not been kept current and do not reflect existing conditions.

Engineering drawings can be tedious and often time-consuming to prepare. Furthermore, their preparation requires a high order of skill and technical competence on the part of the draftsman. Since such drawings are symbolic representations, they also require a certain degree of training, comprehension and visualization on the part of the user. On the other hand, photodrawings are pictorial representations which are instantly recognized by anyone. The item or location is shown in perspective, just as it appears to an observer. It is not broken up into representative sections, views or symbols which must be reconstructed mentally by visualization, for which individuals possess different aptitudes. However, sections or views can be prepared by photodrawing if it is desired.

From a practical viewpoint, the relative ease and speed with which photodrawings can be prepared overcomes another problem encountered with conventional drawings—the out-of-date or non-existent master drawing. For example, when a change is to be made in an existing piping or wiring installation covered by drawings on file, a print of the master file drawing must be taken to the location of the installation and checked very carefully to be sure that the original installation was made as specified on the drawing and that when any subsequent changes and alterations were made they were properly noted on the master drawing. Only then can the design of the new alterations begin.

With photodrawings the information is current as of the day the drawing is made, and no checking is necessary for the picture *is* an accurate record.

In such circumstances photography represents the site as it is, and it is surprising how well it can do this if camera angles are intelligently selected and key items are properly identified on the print. Now there exist means of making these photos reproducible in continuous tone (or by screening) by the diazo (ammonia) process so that copies may be as readily obtained as copies of drawings. In existing installations the problems are not the same as building from the very beginning. Dimensioning is not as important as orientation and direction. When a plant is to be remodeled, all that may be necessary may be an indication that a pipeline or duct go from one place to another, or that this fixture, machine, or tank be removed or relocated. The most important dimensions to be indicated are usually of elevation, direction, and rotation through a plane which is horizontal or vertical to an established base.

Savings to Be Realized Using Photodrafting

The economy of photodrawings makes it feasible to use such drawings when the expense of using conventional drawings of existing equipment or installations would be prohibitive.

For example, in making proposals for field changes, several alternatives can be shown quickly and inexpensively by using different prints of the same photograph and altering from print to print only the changes specific to each alternative.

Or, minor changes in devices or machines which would be complicated to draw, and for which there is no existing file drawing, can be shown on a photodrawing. Standard methods of construction for specialized machines, fixtures or processes can be distributed to the company's plant engineering offices in the form of photodrawings. Photodrawings are inexpensive enough for wide distribution, and are descriptive enough to be handed to local craftsmen who may be called in for electrical, plumbing, ventilation ductwork or mechanical work.

The low cost of photodrawing answers a real need in assembly and inspection drawings. In view of their limited use the cost of preparing assembly drawings in the usual manner is excessively high. As a result, the preparation of such drawings is often limited to those which are absolutely essential. This means that information regarding procedures for assembly and inspection of parts for many component assemblies is dependent upon personal supervision by the engineer or upon reference to engineering prototypes. In cases where subsequent production of an assembly is required after a considerable time interval, this information many times is no longer available. Photodrawing techniques make adequate assembly and inspection information available in a low cost reproducible fashion.

Procedure to Follow; An Outline Sequence

Every photodrawing begins with a photograph. Sometimes an existing photograph can be used, but it is more common for a reasonably competent amateur or, at best, the official plant photographer or a commercial photographer to make a photograph specially for the use at hand. Where the reasonably competent amateur is not available from among existing personnel, then it is wise to call in the official plant photographer. In most offices, however, you will find one, or more very able "shutterbugs" who can be interested and trained in this particular technique, and who will delight in using their amateur skill in such an industrial application.

When photographs are made for photodrawing purposes, there are certain special considerations of picture-taking which depend on the method to be used for ultimate presentation of the facts, the orientation of actual picture-taking to obtain best angles for best results, and the purposes for which the photodrawing is to be made. The procedure consists of the following steps:

1. Conventional pictures are taken in areas in which alterations or additions are to be made to structures, equipment, piping, tanks, railroad tracks, etc.

2. Prints, usually 5″x7″ or 8″x10″ of all photos are made for examination and selection.

3. From the photos selected as being the most satisfactory for use in detailing the required engineering information the negatives are projected onto a process film through a half-tone screen.

4. The screened positive is then printed by diazo method (ammonia process) on a matte surface sepia plastic foil or directly onto double coated intermediate paper, depending upon ultimate print distribution and office use.

5. Engineering information designating the location of any equipment, the removal or change in location of equipment, alterations and/or additions to structure, piping, ductwork, pertinent dimensions, specifications, etc., is added to the foil or paper intermediate in soft pencil or black drawing ink.

6. From the intermediate, whether it be a foil or paper translucency, subsequent intermediates are printed on the double-coated intermediate paper to send on to the Plant Engineering Office for its permanent record. Where it is required only to send prints to the field and for record, then the double-coated intermediate paper can be used exclusively, as it will be cheaper than the foil.

These intermediates are second original copies which supplement or supersede ordinary engineering drawings and are made available for field construction use and on-the-spot print making at point of destination.

A typical step - by - step procedure may be developed as follows:

A typical 35 mm. negative taken from a roll of film, and with the mounting removed is the first "copy." Black and white, or color film can be used equally well. For purposes of photodrafting technique the black and white, continuous-tone film, has the edge. Kodak roll films Tri-X and Plus-X Pan are especially suitable for this purpose; they give good contrast and resolution properties, and should yield good tonal separations even at low degrees of development.

At Campbell Soup Company we have had very good results using Kodak Plus-X Pan film. It is a high speed film and can be used in areas where the use of flash may be restricted, thereby making necessary the use of available light. The speed of this film also makes possible the use of the hand-held camera, affording more maneuverability.

Where it is desirable to show more clearly existing materials and equipment at any given site before a contractor starts work, 35 mm. color transparencies can be made to portray the natural conditions. The use of color will require supplementary lighting and flash equipment for fill-in, etc. Color prints can be made in 5″x7″ size for $1.00 each and 8″x10″ size for $2.00 each by most reliable photo-finishers.

A Screened Positive Transparency is usually made by a photo laboratory from the original 35 mm. negative. If you have the facilities in your own dark-room to enlarge any size negative, then this transparency can be made there. A close inspection will show the screen pattern represented by dots. This is similar to the half-tone engraving used in printing newspaper and magazine pictures. The transparency is used to make a transparent matte-surface foil print or a double-coated intermediate.

A transparent matte - surface foil print (TECNIFAX KSPM, Bruning 55 D, or Kodak Kodalith Autoscreen Ortho Film quality) is reproduced from the screened positive transparency by diazo (ammonia) process in the same way as any other Ozalid reproduction. This copy serves the same purpose as a tracing. Changes, removals and additions are drawn directly on the matte-surface of this foil with a soft pencil. When the "drawing" phase is completed, this foil print is used to make the required field prints or an intermediate for Plant Engineering Office permanent record. First the foil is made, then the screened positive transparency superimposed thereon, then the detailed work is added to complete the "drawing."

A field print is the printed copy which is sent to the field. These prints may be made cheaply and quickly from the foil prints in the same manner as engineering drawings, except that black-line paper is recommended for use to secure a better copy of the photo.

Unless dark room facilities are available, a *screened positive transparency employing multiple picture composition* is made by a photo laboratory from the prior selectivity of five 35 mm. negatives made to a 2¾″x 3⅜″ enlargement (negative). These are arranged in the manner as required for presentation of the format and produced as shown as a screened positive transparency of multiple composition. This matte surface transparency could, if found practical to do so, serve as the final "original" and be marked up with any supporting data, dimensions, notes, field changes, etc., without any other subsequent step in developing a foil print or double-coated intermediate.

A double-coated intermediate paper print (used as a second original) is made directly from the preceding screened positive transparency. Used as the second original, it can be marked up to suit the field requirements of alterations, additions, etc. The subsequent black and white print is then struck from this second original. No need for any draftsman's time being taken as the engineer can arrange composition of transparency and work the intermediate as indicated, thereby expediting the job.

Many small jobs of a "needling" type can be readily expedited by the engineer in this manner without having the job "bottled-up" in the drafting room because of higher priority assignments.

Some Principal Applications

Engineering photographs and resulting photodrawings are most useful and have been found to have real time-and cost-saving advantages over conventional methods in the following circumstances:

1. For field installations of piping, ventilation, ductwork, electric conduit, etc., where new work passes to other installations through an area or areas where there are existing facilities and obstructions.

2. Where new work is to be tied into existing systems, or changes are to be made in existing installations. This would involve piping, ductwork, electrical conduit, switchgear, etc.

3. Where the site is to be cleared for possible new construction.

4. Where removal from site is contemplated, in whole or in part, of existing installations or equipment such as tanks, piping, etc., or even secondary types of structures such as sheds, temporary warehouses, etc.

5. Where alterations and/or additions to structures, relocation or re-

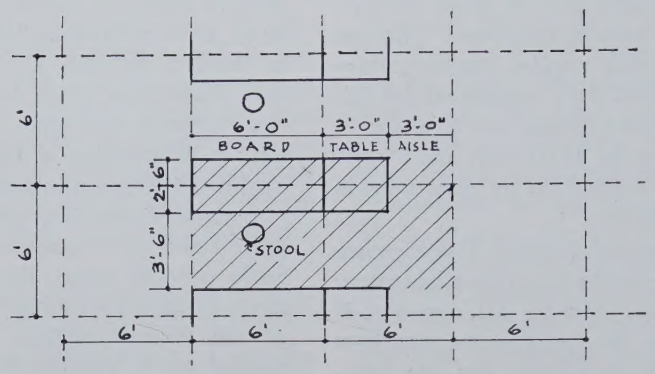
(*Continued on page* 20)

DRAFTIN

BUILDIN

Draftsmen get optim

handsome two-and-a-h



BASIC Planning Module

Photograph by Robert Stahman.

ARCHITECTS spend most of their time in drafting rooms and are therefore presumably in a position to know where and how the drafting area falls short as an efficient and pleasant working space. In designing the International Headquarters building for Dorr-Oliver Incorporated, in Stamford, Conn., Sherwood, Mills and Smith, Architects, had the opportunity of working on a building in which the drafting areas were the largest portion of the space. In fact, the design of these areas shaped the planning of the entire structure.

THE PROGRAM

IT WAS IN 1956 that Dorr-Oliver Inc., an international organization of engineers specializing in the solution of process problems in chemicals, metallurgical, sanitary and similarly related fields, undertook the planning of their headquarters building. In working out the program of requirements, it quickly became apparent to the Building Committee and to the Architects, that the basic space requirements were divided into (1) administrative, (2) technical divisions and (3) services, cafeteria, etc. Administration meant largely office space, while the technical divisions were, for the most part, drafting areas.

By means of a series of diagrams of area requirements for the varied types of personnel and departmental functions, the architects were able to dem-

REAS SET

ESIGN

space and comfort in

llion dollar building.

Photograph by Joseph W. Molitor.

DORR-OLIVER HEADQUARTERS BUILDING located on Havemeyer Lane in Stamford Conn. was designed by Sherwood, Mills and Smith, Architects of Stamford, Conn. The basic planning module was set by draftsmen's space requirements.

onstrate that approximately 45 per cent of the total floor area would be occupied by the technical divisions.

The Planning

While it is relatively simple to represent departments by rectangles showing their relative areas, it is quite a different problem for an architect to plan a building housing these required areas in the proper juxtaposition to each other and to the building concept as a whole.

The next step in the design process, therefore, was to establish a planning module that would best accommodate the area standards as determined for the various departments. As stated above, it had already been established that the greatest number of people to be housed were draftsmen, their supervisory personnel and engineers—approximately 330—in so-called "open" spaces, and then fewer people in private offices.

In analyzing these area requirements, it became apparent to the architects that the space occupied by a single draftsman was of paramount importance. Each drafting position was to be equipped with a 6-foot long by 30-inch wide drafting board, a 3-foot long reference table, allowance for 3 feet of aisle space at the end of the board and 42 inches of stool space. Thus, one drafting position 12 feet long by 6 feet wide was largely responsible for establishing the building planning module—a module that now became fixed at 6 by 6 feet. Had the building been primarily an office building not requiring provisions for drafting areas, the module would perhaps have been 5 feet by 5 feet (as was the case in a subsequent building designed by the same architects).

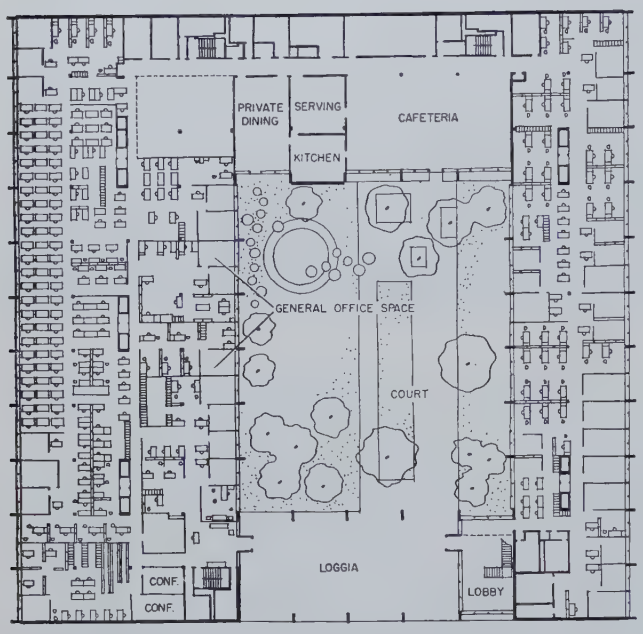
With the 6-foot-by-6-foot module established, a structural bay of four modules each way was set, giving a bay size of 24 by 24 feet. This is larger than normal, but with the flat-plate concrete framing system used, it permitted a smaller number of interior columns.

The Building

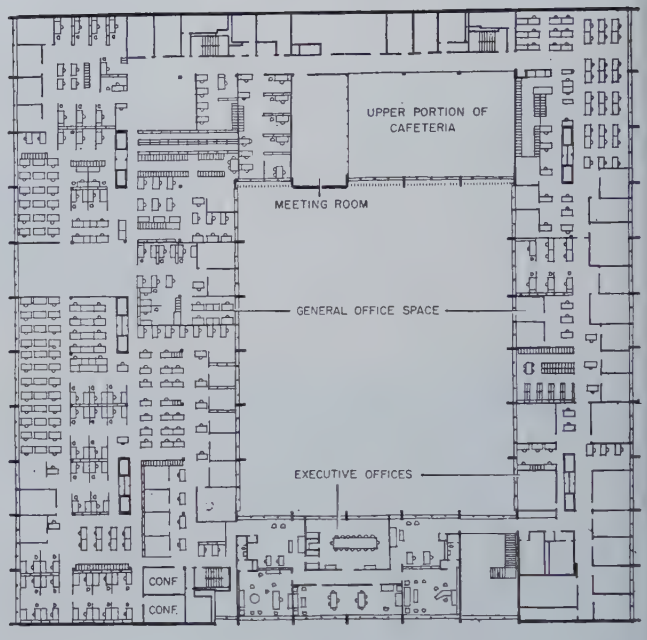
The plan evolved was a hollow square, with all drafting in the north wing (on both ground and second stories), offices in the south wing, cafeteria and private dining room across the east and entrance lobbies, with decorative sculptured sun screen, on the west. The two window walls, oriented north and south, were designed with overhangs and exterior vertical baffles to admit maximum daylight while keeping solar heat to a minimum. A landscaped court in the center created a pleasant outlook for all.

Lighting

It was early decided to have a high level of illumination, as well as controlled daylighting in the building. One-hundred foot-candles at drafting table level permits good sight without the addition of individual desk lights. However, it has been found that draftsmen use desk lamps regardless of the level of illumination. The high light level provided, by 4-foot wide corrugated plastics shields over fluorescent lamps reduces the contrast between the brightness of the drafting



FIRST FLOOR



SECOND FLOOR

boards and surrounding surfaces; this produces extremely comfortable seeing conditions throughout the rooms.

Heating and Air Conditioning

The entire ceiling of the building acts as an air-distribution chamber for the direct-fired air heating and air conditioning systems. Drafting boards and offices can thus be shifted anywhere without need for relocation of air diffusers and ductwork. A perimetrical air-supply system minimizes excessive heating or cooling at window walls. There are no drafts to blow drawings or papers about; instead, the air "oozes" from the plenum space above the hung ceiling. This remarkable ceiling has also been used for sound control and sprinkler piping. It provides acoustical values by the use of sound-absorptive material in all but the luminous portion and at the perforated air-distribution pans.

Color

As to color, the interior designer chose a soft grey for use throughout the drafting areas. Asphalt tile floors and major wall areas are unified and seemingly extended by this neutral tone. Color accents on end walls (east and west) and on structural columns are blue, yellow and orange. These limited-area contrast tones are repeated in interesting fashion throughout the building. Even in basement areas where the drawings vault, files, reproduction equipment, print shop, mail room, boiler room and maintenance facilities are located, the same clean, cool grey is used, tastefully spiced with these accent colors.

The Result

The building was completed and occupied in June of 1958. To quote the architect, "An attempt was made to create ideal uniform working conditions for draftsmen. We planned the drafting area as though we might be occupying the space ourselves and we are very pleased with the results. We feel that it is a pleasant, cheerful, bright place in which to work."

Sherwood, Mills and Smith, Architects; Werner-Jensen & Korst, Structural Engineers; Bernard F. Greene, Mechanical Engineer; Rodgers Associates, Interior Designers; Robert Cronback, Sculptor; Deluca Construction Company, General Contractor; Bye & Hermann, Landscape Architects.

WHAT MOTIVATES A DRAFTSMAN?

by Irwin Wladaver, Associate Editor

WHAT MOTIVATED YOU to become a draftsman in the first place? And now that you are a draftsman, what motivation keeps you at it?

Some of the influences are easy to identify. You knew someone who was a draftsman and he was doing pretty well for himself. Or circumstances forced you to go to work instead of continuing your formal education; somehow you turned to draftsmanship because you felt you could do technical work. Or you consciously turned to drafting because you felt that this might be a step toward an engineering career. Or perhaps it was a chain of accidents and coincidences.

Whatever the motivation may have been — money, status, security, society's present indulgent, almost worshipful attitude toward technology and science—you are now a draftsman. Perhaps all the reasons were the wrong ones, but anyway you're in.

Maybe you like the work immensely. You like the technical give and take of the men in the office (and the not so technical give and take of the gals). You like to look at a finished drawing and say, "Isn't she a beauty? Look at those lines!" You even like the checker.

Maybe you hate the work. You sometimes get to thinking that any other line of work would have been better. You feel you're in a deep rut with no way to go except on and on at the same unchanging level. No way out.

No way out? Yes there is a way out. And I don't mean quitting and starting out all over again in a different racket. There is a way out, less heroic, but more sensible and more rewarding. The way out, as I see it, is to develop a deep, personal interest in the background, the theory of technical drawing in its many fascinating aspects.

THE SOLUTION

I ASSUME you have studied the basic theory of orthographic projection. To hold your job, you prove every day you know the practice. But isn't it true that now and again you run into a problem that almost, almost beats you—a tough problem like the intersection of two oblique cylinders with non-intersecting center lines. Or two cones or a cone and a cylinder? And how many times have you licked the problem by brute force, a grossly inappropriate name for genius?

Now I don't mean to suggest that such intersection problems are easy if you command the theory. At best, they're tedious and backbreaking; I'd much rather assign them than do them. But if you know the theory you need never be at a loss for the most direct and functional approach.

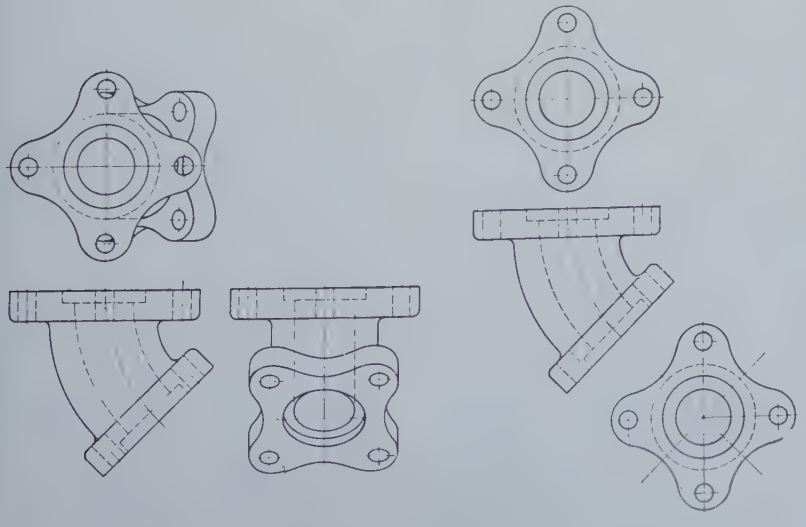
How about an occasional pictorial illustration for a catalog: an isometric, an oblique, or a perspective drawing? Worst yet, a dimetric or a trimetric with crazy foreshortening factors?

I don't claim that a study of the theory of orthographic projection including descriptive geometry, or a study of oblique and perspective systems, or an introduction to projective geometry (I'll bet you never heard of it) will make your job easier or you richer in terms of money. I happen to believe that these studies *will* make your job easier and far more interesting than you ever believed drafting could be. But this is not my point.

It happens that these studies will make you a great deal richer in terms of personal satisfaction. Something, whatever it was, made you go into drafting. Maybe the motivation was superficial and maybe not. But I feel very sure about this: that the deeper your involvement and immersion in the subject matter in which presumably you are expert, the more delight and dignity you will draw from its daily practice.

The realities of any job soon dull the gloss of the anticipation and the newness. The only motivation that really counts, the only motivation that continues is the set of values you derive from the work itself. A deeper understanding is sure to renew your spirit and enthusiasm, to give you a feeling of completeness and adequacy and a conviction that this is the kind of work you're lucky to be in.

This is the best motivation there is.



The Author

IRWIN WLADAVER is Associate Professor of Engineering Drawing, College of Engineering, New York University.

Economy in the Drafting Room

Drafting short cuts, functional design, dimension tolerances, good commercial practice, and statistics are considered in the light of Shop Practice Standards

by J. A. Chingas

Not too long ago I overheard a group of standards engineers extolling the virtues of simplified drafting innovations. One said, "By simply eliminating arrowheads from our dimension lines, we save 40% of drafting costs." Another exclaimed, "We save 40% by using datum planes and no dimension lines." A third boasted a 40% reduction in drafting costs by using free hand sketches. Three times 40% is 120%. Could it be that I was privileged to witness the birth of a great discovery? a free-wheeling, perpetual motion in the drafting room—zero cost drawings? I think not, and am reminded of Leonardo DaVinci's words, "Oh speculators on perpetual motion, how many vain projects of like character you have created! Go and be the companions of the searchers after gold!"

This may seem to be a harsh indictment of a crusade obviously aimed at reducing drafting costs in the drafting room. It is true that under carefully controlled, unique conditions some economy in a draftsman's time can be realized by the use of simplified drafting practices. However, when these exceptions are excluded, there is left the overwhelming majority of American industry whose business interests are so interdependent that a universal blueprint language is a matter of survival.

This language must be understood with facility by an imposing array of people with vastly different backgrounds. Included among them are individuals whose talents can not be expected to include the perception of the trained engineer. Only a small percentage of the individuals who use a drawing have the benefit of drafting education.

The proponents of some of the abbreviated abstractions which have been proposed in the name of simplified drafting practice would have us believe that all users of blueprints have taken courses in descriptive geometry. This is a happy ideal—but hardly a realistic one.

A drafting operation is only one step in a long chain of events which starts with an idea and is completed when the finished product is in the hands of a satisfied customer. Any economy contemplated in a drafting room must be measured in terms of its net effect on the entire sequence of events.

Must a shop foreman take the time to sketch in a missing auxiliary view on a blueprint for the benefit of a machinist; or a buyer spend valuable time in checking with a designer because the draftsman was miserly with his pencil lead? A draftsman protests that his drawing is technically correct and that he is not responsible for the machinist's error which may have cost thousands of dollars and more costly delays in delivery. Yet had the draftsman presented an additional view or shown one more dotted line, had he spent one more minute of his time on the drawing, he would have made the detail clear enough to preclude the machinist's error. What is the true value of a draftsman's minute of time? Real economy in this case demands that the draftsman use more rather than less time in the drafting room!

Perspective

Economy in the drafting room does not start with the drawings. There is a great deal of futility in the concept of a magnificent set of drawings prepared for a gadget which does not function correctly or will not sell. Here, 100% savings in the drafting room should have been realized. The drawings should never have been made! A total loss may hinge on an extra day's engineering analysis or a more astute market appraisal. The decision to reduce a design to drawings is extremely critical. It mobilizes all

services of a corporate organization. It is the first step to produce physical reality out of an abstraction. The costs committed by this decision are almost always irrevocable.

Real cost reduction in the drafting room starts with top-level management decisions, continues through the engineering, pre-drafting phases and must always be measured in terms of total effect on all services. A savings in the drafting room can actually cost many more dollars in the procurement, fabrication, assembly and testing activities of an organization.

Revolutions which accept extremes of simplified drafting practices may result in operations which are penny-wise in the drafting room and pound-foolish in other areas of an organization. In our economy thousands of companies rely upon each other on a business basis for profitable operations. For many of these companies the principal mode of communication, both internal and external, is the blueprint. The language used on the blueprint must be precise. It must allow no opportunity for misinterpretation.

The Frustration of "Good Commercial Practice"

Let us consider the drawing of a cube (Figure 1). I estimate that 99% of industry would accept this. Parts would be produced and inspected and accepted in accordance with the drawing. This is quite a remarkable feat if you consider how much has to be inferred. Of course, it is known that adjacent sides are square to each other and opposite faces are parallel. These are drafting conventions. But how square? How parallel? The drawing shows neat corners. Are they perfect corners? An experienced designer will not rely upon the practical production of a perfect corner. He will expect it to be deburred and its shape will approximate a radius. What radius?

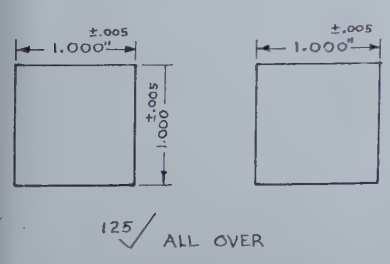


FIGURE 1.

There is the question of the flatness of each surface. Can it be convex or concave within the dimensional limits? And what about random departures from flatness? The drawing does not answer these questions. How is it then that industry contrives to satisfy its needs with drawings so lacking in specification?

The clairvoyant ingredient which has so often come to industry's rescue is called "good commercial practice." If you find yourself on the receiving or short end of "good commercial practice," you are more likely to identify it with lazy specification on the draftsman's part. In other days there was little to choose from among the machinery available to fabricate parts. Companies were self-sufficient and the designers worked closely together with their machine shops. Engineer and machinist were a tightly woven team. In such an environment specifications were abbreviated; the machinist accurately inferred what was missing.

Few companies today are so self-sufficient that their business does not require activities with outside firms; drafting conventions have not kept pace with the times. Reliance is still placed on "'good commercial practice," which is interpreted variously by different companies. "Good commercial practice" has accounted for many apparent failures of a good design. This is so even when the demands of miniaturization, automation, reliability in both commercial and military equipments tend to require even greater precision in parts manufacture.

The necessary precision can profitably be realized in a competitive market only by an equal precision in drawing specification. No more expensive operation should be employed to produce a part than will result in the minimum degree of acceptable quality for that part. Are there alternatives to the solution of this problem? On every drawing the draftsman could enter a definition of terms and conventions explaining exactly what he means by squareness, flatness, parallelism, the condition of corners, etc. This would, in the drawing of Figure 1, probably increase his drafting time

PAGE 4 SHOP PRACTICE STANDARDS THE W. L. MAXSON CORPORATION

4. PARALLELISM

Definitions

Datum Surface in parallelism is a flat surface serving for checking of parallelism.

Controlled Surface (feature) is the one which must be parallel to the datum surface.

If two surfaces of a plate must be parallel, one surface serves as the datum and the second is the controlled surface.

Axis of a Cylinder is the axis of the tightest fitting true cylinder to which it can be freely engaged.

For Purposes of Inspection - The axis of a hole is located by the axis of the largest straight shaft which will enter the hole under thumb pressure.

The axis of a shaft is defined as the axis of rotation which causes the least runout.

Where there is a choice of positions, such as tapered holes or short lands, the most favorable is used.

Axes of cylinders (holes and shafts) are for single continuous diameters. See alignment where more than one diameter is shown on a single axis.

For purposes of definition the engagement of a shaft or stepped shaft to determine an axis or alignment shall be a snug fit, .0000 - .0002 clearance.

Machined Surfaces - Plane and Cylindrical

The condition of parallelism shall be met if the controlled feature for its full length (area for surfaces) lies in a tolerance zone established by two planes parallel to the datum plane or axis and separated by a distance equal to the parallelism tolerance. A datum to which parallelism is controlled shall be established by the high points on the indicated datum surface or by the straight line formed by the axis of the indicated datum cylinder. (See Figures 4A and 4B)

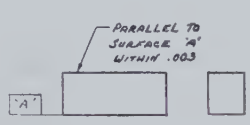
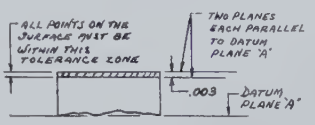


FIGURE 4A



Datum Plane 'A' is established by high points on Surface 'A'

INTERPRETATION OF FIGURE 4A

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at least tenfold. This is obviously not a practical plan to achieve cost reduction in the design of drafting rooms. The adoption of "Shop Practice Standards" can be a complete and economical solution.

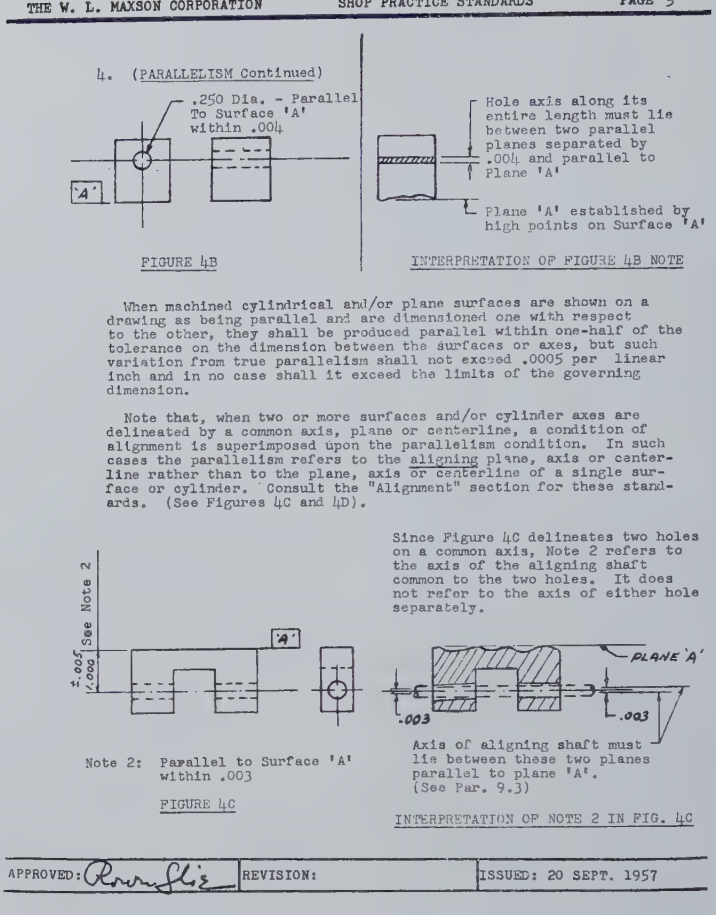
Shop Practice Standards

If the definitions of squareness, parallelism and all the many conditions of form which occur repeatedly on drawings were to be collected in a single brochure, this brochure would contain the beginnings of a good "Shop Practice Standard." The standard is completed by adding quantitative data—the company's own, precise definition of what it considers "good commercial practice" and minimum acceptable quality. This "Shop Practice Standard" is then referenced as a part of each drawing. Unless noted otherwise, the definitions and specifications of the "Shop Practice Standard" apply thus eliminating the vagueness of "good commercial practice." With minimum cost in drafting time, the combination of drawing and "Shop Practice Standard" can produce a precise specification which will be consistently interpreted by all who use it.

One Company's Standard

At the L. Maxson Corporation, in our work with missile and electronic equipments, we have felt the increasing pressures for superperformance and reliability. Specification must be complete and admit no ambiguity. Maxon's "Shop Practice Standard" has proven practical in assisting the designer in preparing his specification and insuring that the draftsman, the designer, the machinist, the buyer, the vendor and the quality control engineer are using a common language. The titles of its 17 main sections are:

1. APPLICATION
   (This section defines the purpose, applicability and relation of Maxson's Shop Practice Standards to commercial products.)
2. FLATNESS
3. STRAIGHTNESS
4. PARALLELISM
5. SQUARENESS
6. ANGULARITY
7. ROUNDNESS AND TAPER



THE W. L. MAXSON CORPORATION SHOP PRACTICE STANDARDS PAGE 5

4. (PARALLELISM Continued)

.250 Dia. - Parallel To Surface 'A' within .004

'A'

Hole axis along its entire length must lie between two parallel planes separated by .004 and parallel to Plane 'A'

Plane 'A' established by high points on Surface 'A'

FIGURE 4B

INTERPRETATION OF FIGURE 4B NOTE

When machined cylindrical and/or plane surfaces are shown on a drawing as being parallel and are dimensioned one with respect to the other, they shall be produced parallel within one-half of the tolerance on the dimension between the surfaces or axes, but such variation from true parallelism shall not exceed .0005 per linear inch and in no case shall it exceed the limits of the governing dimension.

Note that, when two or more surfaces and/or cylinder axes are delineated by a common axis, plane or centerline, a condition of alignment is superimposed upon the parallelism condition. In such cases the parallelism refers to the aligning plane, axis or centerline rather than to the plane, axis or centerline of a single surface or cylinder. Consult the "Alignment" section for these standards. (See Figures 4C and 4D).

Since Figure 4C delineates two holes on a common axis, Note 2 refers to the axis of the aligning shaft common to the two holes. It does not refer to the axis of either hole separately.

See Note 2

±.005 / .000

'A'

PLANE 'A'

.003

.003

Note 2: Parallel to Surface 'A' within .003

FIGURE 4C

Axis of aligning shaft must lie between these two planes parallel to plane 'A'. (See Par. 9.3)

INTERPRETATION OF NOTE 2 IN FIG. 4C

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(4. PARALLELISM Continued)

Since Fig. 4D delineates two surfaces by a single plane, Note 2 refers to the aligning plane common to both surfaces, not to either surface separately. All points on both surfaces must lie between two planes parallel to surface 'A' and separated from each other by .002

See Note 2

±.005 / .000

'A'

.002

This must be held

.995 Min.

1.005 Max.

Plane 'A' established by high points on surface 'A'

(See Par. 9.2 for alignment standard)

NOTE 2: Parallel to surface 'A' within .002

FIGURE 4D

INTERPRETATION OF NOTE 2 IN FIGURE 4D

Casting Surfaces:-When shown parallel, non-draft surfaces shall be produced parallel within 1/32 inch for surfaces less than 6 inches and .005 per inch for surfaces longer than 6 inches. Except that dimensional tolerances shall not be exceeded.

Sheet Metal Surfaces:-When shown as parallel, surfaces shall be produced parallel within .010 per linear inch, except that dimensional tolerances shall not be exceeded. For lengths shorter than 1 inch parallelism shall be within .010.

Sheet Metal Edges:-When shown as parallel, edges shall be so produced within .005 for lengths less than 1 inch and .005/inch for lengths of 1 inch or greater except that tolerances of the governing dimension shall not be exceeded.

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8. CONCENTRICITY
9. ALIGNMENT
10. EDGES AND CORNER CONDITIONS
11. DIMENSIONING PRACTICE AND TOLERANCES
12. SURFACE QUALITY
13. SCREW THREADS
14. GEARS
15. CENTERS
16. TERMINOLOGY
    (This is a dictionary of the terms used in the standards.)
17. A reprint of the dimensioning and tolerancing symbols defined in MIL-STD-8A.

Maxson's Shop Practice Standard is conceived around a good balance between the designer's average need and the shop's ability to produce to that need. For this reason the Standard matches the design engineer's specification most of the time. If, however, the designer decides that the Standard is too tight or too loose for a given application, he can override the Standard by a note on the drawing. This is a basic principle in the philosophy and use of any shop practice standard.

Standardized Dimension Tolerances

There is a commanding tendency in industry to standardize on dimension tolerances. It is expressed on drawings or in a "Shop Practice Standard" as a note which states, for instance: "Unless otherwise noted, the tolerance on all fractional dimensions is ±1/64 inch; on all decimal dimensions, ±.005 inch."

Too often the draftsman will allow this standard tolerance to apply rather than delineate a tolerance based on the uniquely applicable conditions. Thus, tolerances which can be ±.006 to ±.014 are presented as ±.005. Few sets of drawings indicate tolerances like ±.011 or ±.008. This practice is justified on the basis of economy in the design and drafting phases. But how many millions of dollars are lost in fabrication and inspection because of unnecessarily tight tolerances?

Too few draftsmen and designers are educated sufficiently to properly evaluate tolerances. I refer, of course, to the subject of statistics and its application to practical problems in machine and equipment design, automation and the entire area of design specification.

The Role of Statistics

In a technology which is demanding increased productivity with fantastic requirements for reliability, the role of statistics becomes increasingly paramount as a tool in the engineer's "need to know."

Universities can make an important contribution by including in their curricula courses which show how the mathematical science of statistics can be applied with profound and dramatic result in the business of design. Such courses should be on an undergraduate level so that the embryonic engineer is given an early appreciation of this powerful tool. Only in this way will it be possible to fully realize the potential inherent in applied statistical analysis.

Principles involving permutations, combinations, probability and probability distribution have been applied to several designs at The W. L. Maxson Corporation. In every case we realized some combination of decisive cost reduction, predictable reliability and improved function. This is true not only in the more obvious area of product engineering for quantity production but even in single-quantity prototype development for research projects. In fact, it is often not possible to estimate the reliability of a given design (as it will be when implemented in terms of physical hardware) without some knowledge of the science of statistics.

We have established standard design criteria for several recurrent types of design problems by applying a priori statistical analysis. Such a problem is precision gear mesh design. The criteria we have evolved for gear mesh design have resulted in large dollar savings by permitting us to accurately predict back-lash and angular error of an assembled mesh and to use less precise gears and more liberal tolerances with complete confidence in ultimate performance.

Conversely, these same criteria have been used to predetermine the inadequacy of a proposed engineering solution or that it could not be implemented in a practical way. These benefits, derived from a very practical application of statistical analysis techniques, have assured us that statistics will be in increasingly more valuable science not only in our own but in all industry's future.

The relation between statistics and a good "Shop Practice Standard" is very real, indeed. First, the quantitative values in a "Shop Practice Standard" should be based on those which will most probably be specified by the design engineer and can most probably be produced by the company's (or its normal vendors') shop machinery. Statistical evaluation of the company's specifications and its products are prerequisites for a sound "Shop Practice Standard." This is the only technique to derive the best compromise between the designer's average need and the shop machine's ability to produce the designer's normal specification.

It is important that this be clearly understood when preparing a "Shop Practice Standard." An illustration is in order: If you discover that all your milling machines will consistently produce parallel surfaces with an error not greater than 0.005 inch per inch, you are wise to state this as a level of minimum acceptable quality in your "Shop Practice Standard." This should, of course, meet the requirements of your designers' normal specification. If your designers are accustomed to specifying a tighter tolerance on parallelism, you had better take a severely critical look at these specifications. If they are correct, your shop is equipped with the wrong milling machines and that is why the profits are low—not the recession.

A "Shop Practice Standard" is not the last word in specification. The designer must always be able to veto it by simply specifying his exception on the drawing. But if it is not stated otherwise, the "Shop Practice Standard" defines your standard of minimum acceptable quality. This standard, as a referenced part of every drawing, for the first time makes it possible for designers, draftsmen, machinists, buyers, inspectors and vendors to use the same language.

The Author

J. A. Chingas is Manager, Product Engineering, The W. L. Maxson Corporation, New York. His article is based on a paper he presented at the Seminar on Cost Reduction in the Design and Drafting Rooms held at the University of Illinois on April 8, 1959.

CAMERA CUTS COST OF PRINTS

Reproduction of engineering drawings at half-size will save San Francisco Naval Shipyard $150,000 *on drawings for two Guided-Missile Frigates.*

In the first two months of this year, the San Francisco Naval Shipyard saved $15,000 in paper and folding costs by using half-size reproduction of most of its engineering drawings. Filing space requirements were reduced to about one-fourth.

Martin F. Ahlborn, supervisor of reproduction at the San Francisco Naval Shipyard, says that the reducing camera,* which is responsible for these dramatic savings, has paid for itself several times over in the little more than a year it has been in operation.

Mr. Ahlborn reports that plans are now underway to use the reducing camera in the construction of two new Guided -Missile Frigates. The KLG23 will be built by San Francisco, the DLG24 by Puget Sound. Gibbs & Cox, naval architects, are preparing the plans – basically the same for each ship—for Bath Iron Works. Instead of purchasing two sets of reproducible drawings from Bath Iron Works, the San Francisco Naval Shipyard will purchase only one set of prints. From this set, they will make half-size reproductions for their own use and for Puget Sound.

"We estimate that this system will save $150,000 ($75,000 per ship)," Mr. Ahlborn says.

COMPARING ease of reading a full-size blueprint with a half-size camera copy.

Less Storage Space

The San Francisco Shipyard is also reducing ship-plan indexes to half-size, in order to relieve a critical storage problem. When completed, the entire file will take the space of three legal-size cabinets; ten cabinets are now required to file them full-size.

Last year the Yard reported a saving of $1,920 on just two submarines which required reduced - size, onboard plans. These two jobs called for reproducing 150 drawings. Using the reducing camera, only 16 hours of working time were required and the total cost was $180. The previous method would have taken 200 hours and cost $2,100.

The Navy has found the camera useful in reducing to a manageable size drawings that often run as long as 30 feet. Such sizes are hard to handle, hard to fold and store, and expensive to reproduce. By using the camera at a reduction of 2-to-1, half-size copies of these drawings were obtained, which means an area-reduction of 75 per cent. For example, a drawing 34 inches by 110 inches (26 square feet) when reduced to half-size becomes 17 by 55 inches (6.4

*The Collins-Peerless Neoflow Reducing Camera, sold by Peerless Photo Products, Inc., Shoreham, Long Island, N. Y.

OPERATOR feeds the drawing to be reduced into continuous-flow camera.

square feet), a saving of 19.6 square feet. Reductions of 3-to-1, 3½-to-1, 4-to-1, 6-to-1, 7-to-1 and 8-to-1 are also possible.

Operating Principle

The reducing camera operates on a continuous-flow principle and utilizes the method of reflex photocopying. That is, the image is reflected from the surface of the original as it moves continuously across a lighted slot. The image travels up along a light-path through a sequence of mirrors and a reducing lens until it reaches the sensitized material on which the copy is made. The sensitized material moves in exact synchronization with the original.

The camera can copy large engineering drawings up to 42 inches wide—and any reasonable length—at speeds up to 25 feet-per-minute. These originals may be in any medium or on any stock—pencil or cloth tracings, blueprints, whiteprints, or photographic reproductions on either translucent or opaque paper. The reduced-size copies are made on a continuous roll of projection-speed photographic paper (or film) which can have a maximum width of 21 inches. The copies can then be used as intermediates for producing working prints in quantity by conventional diazo or blueprinting processes.

The multiple prints are used by the San Francisco Naval Shipyard as work prints for general distribution throughout the Yard's production and repair facilities, for purchasing, shop orders and other uses. The smaller-size prints are also used for inclusion in parts manuals, instruction books, etc.

In 1958 the San Francisco Naval Shipyard used the reducing camera on only 50 per cent of all drawings issued to production shops, and the camera was in use in only 11 of the 12 months. Even so, the savings were substantial, as the following figures show:

Data

No. of dwgs. reduced....	8,300
No. of reduced-size working prints produced....	166,000
Sq. ft. of reduced-size paper negatives	53,950
Sq. ft. of reduced-size blueprints	1,079,000
Cost per sq. ft. to produce blueprints	$0.02
Cost per sq. ft. to produce reduced-size paper negatives	$0.20

Cost Analysis

Half-Size Method

Cost of reduced-size blueprints	$21,580
Cost of reduced-size paper negatives	10,790
Cost of folding reduced-size blueprints	4,150
Total cost to produce reduced-size blueprints ..	$36,520

OPERATOR checks developed prints as they pass drying section of processor.

Conventional Full-Size Method

Cost of full-size blueprints	$86,320
Cost of folding full-size blueprints	8,300
Total cost to produce full-size blueprints	$94,620
Total Direct Cost-Savings.	$58,100

(*Continued on page* 32)

COMPARING storage space for full-size prints (left) and half-size copies (right).

Photodrafting Techniques

(*Continued from page* 9)

moval of railroad trackage, yard roadways, storage areas, etc., are proposed.

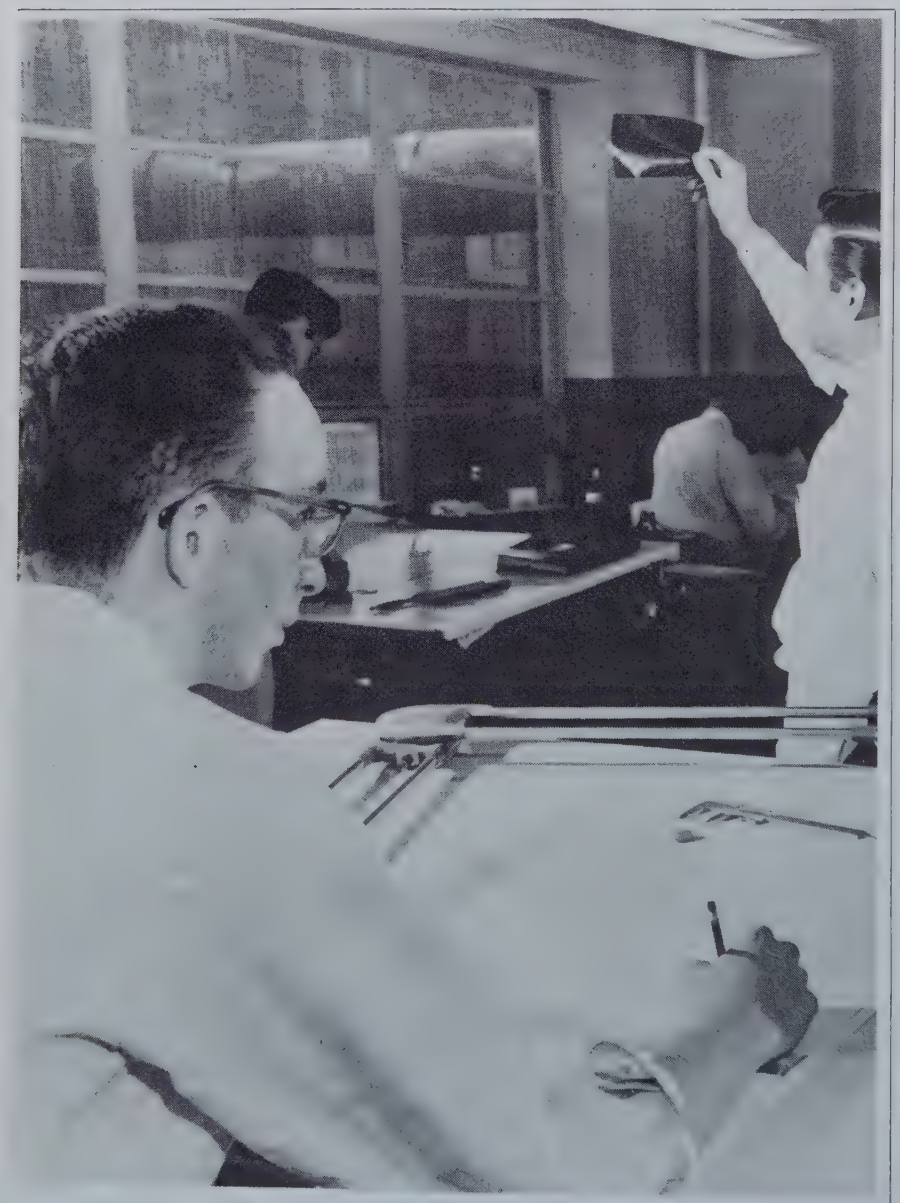
6. To assist the engineer in illustrating his reports of field trips; completing an analysis of the physical aspects of any area; safeguard the possibility of overlooking essential equipment or controls.

7. Where working model mock-ups, once decided upon, can be photographed advantageously from various angles, and photodrawings made readily available with detailed notes and dimensions for sending on to architects, engineers, consultants, vendors, fabricators, etc.

8. For the preparation of slides for training courses and methods evaluation.

9. For the education and training of non-technical personnel, in particular, those who will be using the proposed installation to more rapidly orient themselves and become acquainted at least pictorially with opertions not otherwise familiar to them. The frightening aspect of an engineering drawing with all of its unfamiliar technicalities is eliminated.

10. With Campbell Soup Company Plants located throughout the United States, several in Canada and two in England and Italy, engineering information can be more readily, more clearly and more effectually prepared and transmitted either way in exchange. *One* picture, properly taken, can save 1,000 words where the full meaning from correspondence could be hard to interpret.



Drafting room management: Watch for the first in a series of articles by George C. Schmidt, Chief Draftsman, Campbell Soup Company on "Operations and Procedures for Engineering and Drafting Supervisors." Coming in the December issue of GRAPHIC SCIENCE.

COSTS

ORIGINAL PHOTOGRAPHIC NEGATIVE COSTS will vary widely, depending on the equipment used, the photolab doing the work and the time involved in securing the pictures.

The current average costs of services and materials, for pictures used, should be approximately as follows:

For 8½"x11" presentation:

1. Enlargement from 35 mm. negative to 8" x 10" negative (on film)	$1.50
2. 8" x 10" positive, glossy finish examining print	.50
3. 8" x 10" positive, paper transparency	.50
4. 8" x 10" positive, film	1.00
5. 8" x 10" screened positive transparency	6.00
6. Sepia matte-surface foil (intermediate)	.50
7. Sepia (double-coated intermediate paper)	.25
8. Print of finished composite (8½" x 11" Ozalid paper)	.15

From the preceding tabulation of all the costs which need be considered, a typical 8½"x11" resulting foil presentation could cost as little as $3.50 for a *single* choice picture, involving items 1, 2, 4 and 6.

For a multiple choice, consisting of five such 8"x10" pictures arranged to show several viewpoints, and on 30"x40" finished-size paper intermediate, the cost could be $41.50, involv-

ing items 1, 2, 5 and 7 (30″x40″ intermediate costs $1.50).

For a multiple choice, consisting of five 2¾″x3⅜″ pictures, arranged to show several viewpoints, and on a single 8½″x11″ finished-size paper intermediate, the cost could be $26.25.

Costs of Producing 2¾″x3⅜″ Enlargements from 35 mm. negative approximate the following:

1. Enlargement from 35 mm. negative to 2¾″ x 3⅜″ negative (on film)	$ .50
2. 2¾″ x 3⅜″ positive, glossy finish examining print	.20
3. 2¾″ x 3⅜″ positive, paper transparency	.20
4. 2¾″ x 3⅜″ positive, film	.35
5. 2¾″ x 3⅜″ screened positive transparency	4.50

All of the above quoted approximate costs would be considerably reduced for those companies having their own photographic and printing departments.

Steps for the Photographer

The following steps have been set up on the assumption that the photography will be done by a reasonably competent amateur. Experience has shown that the photographically enthusiastic amateur possessed with mechanical aptitude, knowledge of and interest in manufacturing processes, initiative, imagination and personality, can be depended upon to obtain good, usable pictures. By his photographic training and experience he will soon learn that the requirements of industrial photography are not as exacting in aesthetic value as customary picture-taking would demand. He will readily adjust to new procedures and techniques of photography in industry. His ability to get along with people will be an important factor in successfully obtaining effective pictures.

Although an ample number of pictures should be made, he should avoid random picture-taking. This may give the illusion that the area has been adequately covered, but will result in few usable pictures. Pictures should be planned and taken with certain objectives always in mind.

Determine the use to which the picture will be put, and what the en-

gineer and craftsman who will work with the picture will want to see in it.

Try to find out the general extent of the new installation, so that when the new work is shown in the finished engineering photo there will be a minimum of distortion.

If there is a choice as to the location of the new work, the photographer should consider taking pictures from a number of angles, so as to give the engineer the opportunity to study all possible locations and routing for the new work and permit him to select a photo on which he can represent the planned installation with a minimum of distortion.

There should always be a sufficient number of "extra" pictures — again taken from various angles — which, though they may not be selected for the final presentation in the photodrawing, will serve to locate and permit the recording of all possible interferences and clearances in the field. They can be sent along back to the field as exhibits or pictorial details in explanation and support of the photodrawing, tied in as to location by numerical reference on the photodrawing.

Pictures must be identified as to camera position, plant location and camera angle. This step will be further explained in more detail, subsequently.

Endeavor to take pictures from such an angle that the new work can be drawn on the photographic reproduction medium in a form similar to an isometric rendering.[1]

It is usually a good idea to take a picture showing a whole area before closing in for details. This picture can be used to key subsequent detail photos together. In taking this overall picture, an extreme wide-angle lens is very valuable. In lieu of the wide-angle lens the camera position can be changed so long as the relationship to subject remains constant through any lateral movement of the camera, then the resulting pictures can be cut and joined together for a panoramic effect.

By using high quality lenses (which may or may not be available for use by the amateur photographer) and placing tape or yardsticks in strategic positions, important measurements can be shown on the photo, but such photographic dimensioning has certain limitations which must be kept in mind. Generally, the longer the focal length of the lens, the better it is for photodrawing use. The long focus minimizes perspective distortions caused by a wide viewing angle from a close position.

1. The dimension established holds true only for the extremes. Intermediate points cannot be established by the simple use of dividers, scales or rulers.

2. Reasonably accurate measurements are possible only for objects on the same plane as a ruler, which is itself parallel throughout its length (either on the horizontal or the vertical axis) to the film plane.[2]

Existing work can be more easily identified if it is marked with chalk or paint before being photographed. Individual pictures, as taken, can likewise be numbered in sequence merely by painting or chalking the proper number on conspicuous surfaces of the apparatus, floor, wall or some other convenient position. A poster board could also be painted with the number and placed prominently in position.

Camera and Lighting Technique

While the professional photographer will select the combination of camera techniques and materials necessary to obtain optimum photographic results under a given set of conditions, the amateur or less experienced photographer usually is limited in his equipment; but, by using a camera with which he is familiar, he should be able to obtain reasonably clear and sharp, well-lighted photographic records in sufficient number to fully describe the subject matter.

Since 5″x7″ or 8″x10″ prints will generally be used, the processing must allow for this degree of enlargement. Professional or custom finishing (not the corner drug store type of mass-produced finishing) will allow use of cameras with a negative as small as 35 mm.

A 35 mm. camera, properly used, has distinct advantages in this type of work because of the compact size, larger number of frames available in one loading, low film cost, greater depth of field, and — with some cameras—interchangeability of lenses.

Lighting

Various kinds of lighting which can be used with indoor subjects are: (1) flash on camera (use protective cover over reflector if flash bulb is used); (2) flash off camera—single or multiple (use protective cover over reflector if flash bulb is used); (3) photofloods; (4) painting with artificial light; (5) available light. While no single one of these techniques can be considered best for all subjects, any one of them can be employed for all subjects, and acceptable results will be obtained.

On out-of-doors subjects in bright sunlight, it is usually advisable to use flash as a fill-in light, thereby helping to overcome deep shadows and reveal otherwise unseen details or possible obstructions.

If pictures are to be taken in areas where explosive materials are used or manufactured, it would be preferable to take a time exposure with the camera mounted on a tripod and use available light. Aluminum sheeting, white canvas drops or white cardboard reflectors can be used to help overcome deep shadows.

Because angles are so important, it is likely that some special equipment such as ladders, planks, or the like, may be needed. Be sure that such aid is available, and do not hesitate to climb into unusual places to get the best angles for the pictures wanted. Pictures of piping, controls, etc., under tanks may require you to lay prone on the ground to capture the desired result.

Preparatory to the taking of photographs, it will be necessary for the

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[1]Note: A Polaroid-Land Camera is very useful as an aid in planning pictures. Having an immediate print helps in planning what pictures to take and from what angles, and whether the picture taken will lend itself to the planned objectives. Furthermore, the new Polaroid positive transparency system, now available, makes possible on-the-spot transparencies 3¼″ x 4¼″ which can readily be used for photodrawing work.

[2]Note: The one major difficulty as yet unsolved is that of reducing or eliminating the apparent convergence of receding parallel lines as seen in a normal photograph.

By using extremely long focal length lenses and setting the camera far enough away, it is possible to minimize this convergence such that the lines appear to be parallel—but—to achieve the maximum correction and maintain a reasonably usable image size, the camera would be about 1,000 feet from the subject and necessitate using a lens of about 75 foot focal length. Obviously, this is impractical.

One company, at present, is photographing their model mock-ups from a distance of forty feet using a 35″ process lens to help reduce this line convergence.

photographer to review with the engineer the proposed arrangement drawing for the installation and study the physical area of the site for determination of possible approximate routings the new work might take.

In taking these pictures, it is important that the photographer visualize the possible routings for the altered or added new work and use the angle from which the new work will be more easily seen in the photograph.

Having taken all the necessary pictures and obtained the examining prints, a selection is then made to determine which will be used in the photodrawing.

A plot plan of the area should be made to key the photographs together. This plot plan will establish a "job or building north," which will deviate from true north to the extent that is necessary to "square" the four cardinal points of the compass with the building walls. This is necessary so that the photographer can speak of facing north or east without equipping himself with a compass.

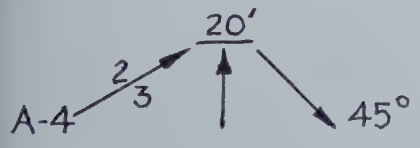
The photographer, when using cardinal points, always refers to the direction in which *he* is facing.

Coordinates should be established on the plot plan so that the photographer can speak of standing at A-4 or C-5 to take the picture. This locates the *spot* on which he stands.

To indicate the *direction* in which the camera is aimed, the "clock" method is used with north at 12 o'clock, south at 6 o'clock, etc. This is more readily understood than compass points and allows for a minimum of twelve directions.

Elevation should be calculated from the floor. Sometimes it may be desirable also to approximately describe the angle of elevation or depression made by the camera from the horizontal plane of camera's position.

A shorthand - type of description might read:



Being interpreted means:

Picture taken from intersection of A and 4 coordinates, with camera pointed halfway between 2 and 3 o'clock, and downward at an angle of about 45° from an elevation of about 20 feet from the floor.

Preparation of Engineering Photographs

The alterations or additions are now drawn over the pictures. In detail, there are two alternate ways of doing this.

A sheet of 8″x10″ matte-finish acetate film is placed over the photo, and the drawing is made on this acetate film. This can be reproduced by ordinary photographic means. The overlay is printed in matte - finish film by diazo (ammonia) process. This is then issued in the form of a photo with an attached overlay.

Or an 8″x10″ screened positive transparency is made of the picture. It is then printed on double-coated intermediate paper or matte-surfaced foil by diazo (ammonia) process. The alterations or additions are drawn on the double-coated intermediate paper or matte surface of the foil with

India ink or soft pencil. These can be reproduced on an Ozalid machine and issued in the form of a *single photo.*

It must be recognized and understood that this is not a process to be consigned to the blueprint room. The selection of personnel for such photographic assignment is extremely important. The full utilization of the latent possibilities requires the skill and knowledge of the photographer. For the resulting pictures to be fully effective, the photographer should be fully acquainted with the production methods of the plant and related problems. Cooperation between the photographer and the plant officials is most essential if the full value and effectiveness of such industrial pictures are to be realized. This is another good reason to use the amateur skill possessed by a member (or members) of your own organization.

A knowledge of good drafting practices will materially aid the engineer engaged in supervising the work. Drawing technique must be developed by him before he becomes proficient at working in the perspective of the photographs. And, until such time as distortion-free cameras are available, he must also learn to master the distortion and line convergence which is common to photographs.

Summary

The use of these photographic techniques, in combination with those practices already in use, may well suggest numerous variations and innovations which can be depended upon to effectively reduce drafting room costs.

It is not intended, however, to leave you with the impression that all drafting can or will be eliminated. It will still be necessary to place all lettering and dimensions on the drawings manually. As in the case of conventional drafting, it may still be necessary, on occasion, to detail certain areas separately. On new work, for instance, it will not be unusual for the engineer or draftsman to supplement the photodrawing with conventional drafting work showing otherwise unfamiliar details of design and construction.

You can be assured that through the judicious use of these techniques of photography, a substantial amount of time can be saved in your engineering department.

With plant improvements in processing techniques taking place almost daily, and with numerous changes constantly being made by plant operating departments, it is not profitable to keep engineering drawings revised on a current basis. Instead of sending an engineer or draftsman out to the field to check the accuracy of existing drawings, or prepare sketches and take the necessary dimension to properly revise the present drawings or make entirely new drawings from such field data, time can be materially reduced by substituting photographs for those sketches. Since the photograph shows the necessary background, all the engineer or draftsman need do is to draw in the new work and add any notes or dimensions required for proper location. The savings using this method will vary with the job assignment, but the time spent at the plant measuring and sketching will always be substantially reduced.

What should be the size of this industrial photographic department and what is management's position in this photographic activity?

There are three broad types of photographic activity in industry today where:

1. The photography is done by a commercial or free-lance photographer.

2. No photographic department is involved, only the part-time services of an employee who has demonstrated his amateur status.

3. A photographic department is formed with one or more full-time employees.

The first of these three types does not involve either a photographic department nor a plant photographer and, because of reasons already pointed out, is not too desirable.

The second type can be the result of an experiment by management to determine the value of an application, a recognition by management of the potential value of photography, or the application of photography by an amateur to his industrial job. Such an experiment can be the start of an extensive photographic operation and can result eventually in the organization of a photographic department.

The third type includes a photographic department with one or more full-time employees. This can be the result of a gradual increase in the use of photography or a management decision to establish the department.

However, it must be understood that no photographic activity will be entirely successful unless the department is accepted by the company management, is recognized as a good economic proposition, has personnel with imagination, new ideas and initiative, and is capable of continually expanding its usefulness to the company.

Centralized services can provide the most efficient use of photography within the company. The operation of these services should be under the direct control of a capable photographer who answers to the supervision of the division of the company responsible for the photographic department.

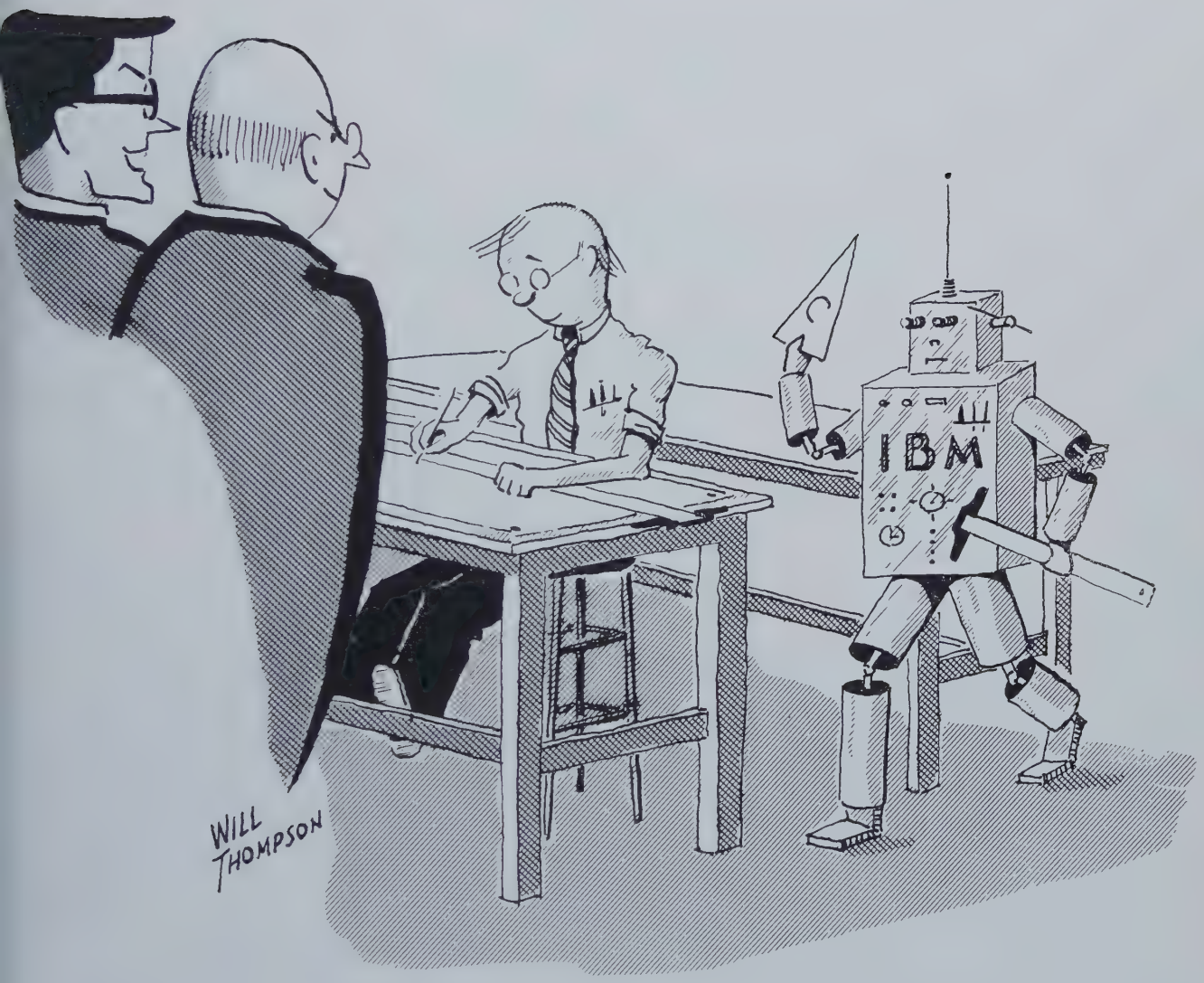
In those companies where centralized photographic services are successful, the management is fully appreciative of the potential value of the photographic department and has instructed its supervisor to develop applications of photography in the plants. Supervisory personnel throughout the plants are advised about the photographic department and its services; they consult with its supervisor when photography may be helpful in a problem, and use pictures and photodrawings or other photographic records whenever possible.

What does "tomorrow" hold as to the future progress that will most certainly be made with photography in industry? No doubt, there will be much to startle us beyond our ability today to comprehend. The present developments in cameras, film and associated photographic equipment coupled with any new innovations, now only a dream, in the future will allow photography to be used more effectively in even more unusual applications.

We should all keep informed of the many developments in allied fields which may possibly be combined with photography to produce better and cheaper ways of serving industry. View all ideas, no matter how impossible they may seem, with an open mind and an eye to possible application. Before you say "It can't be done," be sure someone else has not already done it.

The Author

George C. Schmidt is Chief Draftsman, Campbell Soup Company, Camden 1, New Jersey.



"And I say McGarety and his damn engineers should give a little more thought to improving their own department!"

Graphic Perspective

by Eleanor W. Thompson

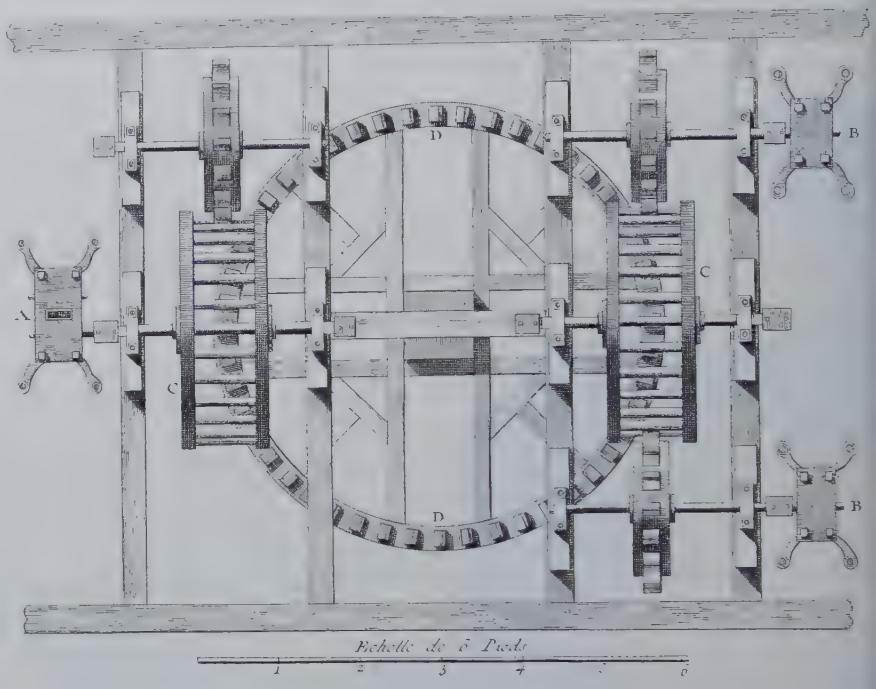
LAST MONTH, on this page, we suggested that the draftsman springs from a long and distinguished lineage. If confirmation of this were required, one need only scan the pages of *A Diderot Pictorial Encyclopedia of Trades and Industry.** This work contains 485 plates selected from the original *Encyclopédie, ou Dictionnaire Raisonné des Sciences, des Arts et des Métiers,* a mighty work of 34 volumes edited between 1751 and 1780 by Denis Diderot, French encyclopedist, philosopher and writer.

In the 18th century, Diderot said, "Let us at last give the artisans their due. The liberal arts have adequately sung their own praises; they must now use their remaining voice to celebrate the mechanical arts. It is for the liberal arts to lift the mechanical arts from the contempt in which prejudice has for so long held them . . . let us teach them to have a better opinion of themselves; that is the only way to obtain more nearly perfect results from them."

Diderot was, of course, referring to the working craftsmen in metal, glass, leather, textiles, etc. He then proceeded to have his *Encyclopédie* illustrated by draftsmen who produced one of the finest achievements of the graphic arts in the 18th century.

We need not here go into the political and philosophical background of Diderot's work. What is worthy of note, however, is the fact that, 200 years ago, the draftsman's skill had reached a degree of perfection where, in the words of the publisher, "Most of the plates are so clear and accurate that an engineer following them could construct machine and plant and go into 18th century production."

These copper plates, in themselves among the finest examples of the engraver's art, have a quality and precise observance of detail that place them at the top in the field of technical illustration. In addition, there is ample evidence that the illustration technique used in Diderot's *Encyclopédie* shows an awareness of many of the drafting principles in use today. Again and again we find confirmation of the knowledge and use of orthographic projection as a tool for the communication of a theoretical design concept. Typically, an overall picture or an illustration is presented in much the same manner as an assembly drawing in today's engineering drafting rooms. Sections at right angles are presented, one lengthwise and one crosswise. We see cutaway views of the important assemblies in place, or separately shown, and finally the individual parts.



To quote from the introduction to *A Diderot Pictorial Encyclopedia of Trades and Industry,* "The *Encyclopédie* took a giant step toward replacing the Gothic instinct that techniques are trade secrets, mysteries to be concealed by the practitioner, with the concept of uniform industrial method to be adopted by all producers. . . . A picture speaks what words conceal and although the text of the Encyclopedia carries long accounts of the principles and practices of crafts both major and minor, descriptions alone would have been arid and would have fallen far short of the purpose. The plates to which most of the articles are keyed contain the essential record of 18th century technology."

On this page is one example of these magnificent plates: a plan view of a rolling mill used in the manufacture of coins. A design for a rolling and slitting mill for working wrought iron appears on our cover.

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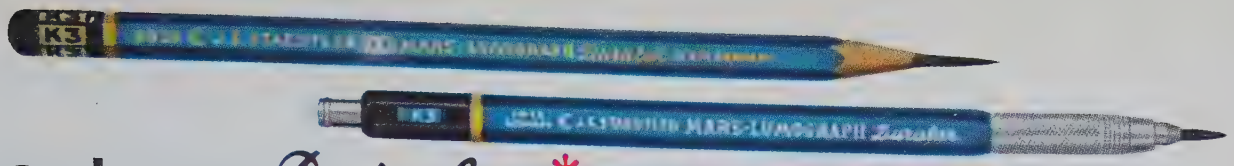
*A DIDEROT PICTORIAL ENCYCLOPEDIA OF TRADES AND INDUSTRY. Manufacturing and the Technical Arts in Plates Selected from ***L'Encyclopédie, ou Dictionnaire Raisonné des Sciences, des Arts et des Métiers*** of Denis Diderot. Edited by Charles Coulston Gillispie. 485 full-page plates, over 2,000 illustrations. Total of 920 pp. 9 x 12. Two Vols. $18.50**



. . . and now *Duralar** joins this famous family of fine pencils

*The only pencil specifically designed for work on matte-surface tracing film of Mylar®, DURALAR is the newest in the complete line of fine MARS drafting products. All are imported from West Germany and made to meet the highest professional standards. Below ● Bright-hued LUMOCHROM pencils in 24 colors for color-coded drafting and perfect reproduction ● LUMOGRAPH graphite drawing pencils in 19 degrees; some degrees available with erasers, some with special chisel points ● TECHNICO lead holders for color and black graphite drawing, with new sure-hold finger grips and degree markings for quick identification; also with clips, for pocket use ● NON-PRINT pencil and leads make notes and sketches that will not reproduce ● Pencil sharpeners in STANDARD and "DRAFTSMAN" models; latter with adjustable point-length feature. ® T.M. FOR duPONT'S POLYESTER FILM

MARS

J. S. STAEDTLER, INC.

HACKENSACK, NEW JERSEY

New Products

Lettering Templets

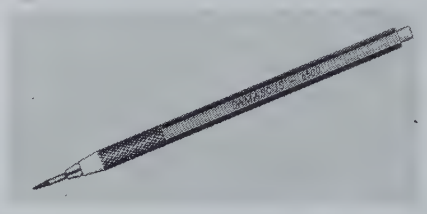
New lettering templets are said to reduce time and cost of hand-lettering and composition. Known as "fill-in" templets, they not only outline perfectly formed letters but fill in the letters as well. Each templet has double-engraved letter grooves. The outer groove is engraved deep for outlining the letter with a fine-line pen and a fine stylus; the inside groove is engraved shallow for filling in letters with a wide pen and a wide stylus. This eliminates hand-filling with pen or brush. Designed for use with Varigraph Lettering Instruments, the templets are produced by Varigraph Co., Madison 1, Wis. Letters ranging in size from 6 to 96 point may be produced from a single templet; lettering may be condensed or extended to fit the desired area. The new Varigraph templets are individually engraved in a light metal alloy. They are said to be extremely accurate.

Dummy Copy

Thin gauge, self-adhering acetate sheet, printed to give the impression of indicated lettering, provides a fast new way to accurately indicate blocks of copy on layout and comprehensive dummies. Called Copy - Block, this new shading medium has been developed by Craftint Mfg. Co., 1615 Collamer Ave., Cleveland 10, Ohio. It is available in three sizes—8, 10 and 12 point. In use, the sheet is placed in position on the layout, cut to size, the backing sheet is removed and the desired Copy-Block is burnished down. The sheets give the impression of indicated lettering and are not intended to read as type.

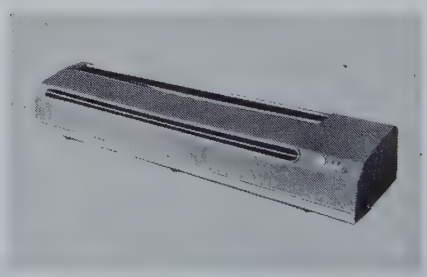
Aerosol Cleaner

Aerosol packaged cleaner-transparentizing material is now available in 16-ounce spray containers. Called the CTS Method, the cleaner-transparentizer is produced by Hampton Processes, Inc., Newton, N. J. According to the manufacturers the aerosal spray container gives a more uniform coverage than hand application, in a fraction of the time. It also greatly reduces solution waste.



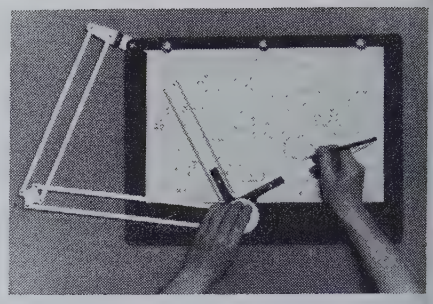
Drawing-Lead Holder

A metal drawing-lead holder with a hardened steel clutch is said to withstand hard usage and to give years of satisfactory service. According to the manufacturer, constant pointing of the lead does not grind away the clutch. These drawing - lead holders are made and guaranteed by Richard Best Pencil Co., Springfield, N. J.



Print Processor

A recently announced processing unit will handle engineering drawings, maps and other documents up to 27 inches in width by any length. Called Anken 27, the unit is produced by Ampto, a subsidiary of Anken Chemical & Film Corp., Newton, N. J. It will reportedly make black-on-white copies from blueprints in one step, process projections from microfilm to new Planacopy papers and handle film on paper transparencies for use on diazo units.



Portable Drafting Machine

A machine consisting of a 15 by 20 inch Masonite board, parallel mechanism and a protractor complete with scales has been added to the line of portable equipment available to draftsmen. The low-cost unit (Model 112-M) is manufactured by Drafting Equipment Co., 502 Randolph St., Meadville, Pa. The board is designed to handle 12 by 18 inch drawing sheets. Three special circular paper clamps offer minimum interference to the scales. The parallel mechanism works from an off-corner mounting, giving easy coverage of board surface with both vertical and horizontal scales, the 9-inch scales are reversible.

Blueprinting Lamps

Motor - controlled integral printing lamps are said to reduce exposure time to a minimum while allowing the blueprint machine operator to devote full attention to his work. The fully-automatic regulating arc lamps in the Constantarc Mark 50 line are produced in standard 100- and 140-ampere models for 220 or 440 volts, 60-cycle ac; Macbeth Arc Lamp Co., 141 Berkeley St., Philadelphia 24, Pa., is the manufacturer. Mounted on swiveling casters, the unit is a complete lighting package; it consists of a console control panel, reflector and exhaust unit. The operator sets the exposure time and pushes the start button to obtain a predetermined, uniform exposure of high-intensity light. A pushbutton trim switch electrically separates the carbon holders to trim the lamp while all other power is off, protecting the operator from any possible electric shock. Recommended maximum coverage for the 100-ampere model is 40 by 50 inches; for 140-ampere model it is 60 by 80 inches.

New Products (continued)

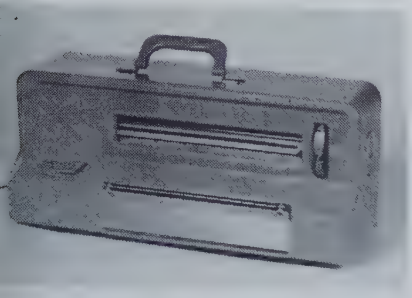


Photo Copying Machine

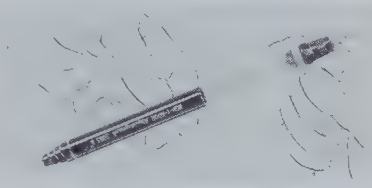
Automatic exposing, processing and printing of 60 to 120 copies per hour is said to be accomplished by a new photo copying machine. Designed and manufactured by General Photo Products Co., Inc., Chatham, N. J., the Genco Porta-Fax machine reproduces anything printed or written up to 9¼ inches in width by any length. It reproduces colors and ball-point pen lines and may be used for duplicate copies from negatives, two-sided copies, color-coded sheets and transparencies. The unit weighs 15 pounds, measures 18 by 6 by 10 inches and is equipped with a carrying handle. It is supplied ready to plug in; it operates on 115 volts ac.

Drafting Machine

Designed for use on any board at any angle, a recently introduced drafting machine is said to represent a complete departure from conventional drafting machine design. Called the Neoglide drafting machine, the unit is being made by Charles Bruning Co., Mount Prospect, Ill. Its enclosed counterweight unit provides positive counterbalancing at all board angles from horizontal to vertical. The machine's major moving parts are equipped with nylon wheels riding on rigid tracks. Precise machining and close tolerance assembly are said to result in resistance-free movement; there are no screws or knobs to adjust. The protractor head operates on a touch control method for angle selection. The Neoglide is reported to have excellent board coverage. During the periods when the machine is not in use it can be pushed to one side, leaving the board unobstructed.

Reproduction Cloth

A new photo-sensitized reproduction cloth characterized by a high grade fabric base material has been announced by Peerless Photo Products, Inc., Shoreham, Long Island, N. Y. Fabric has what is described as "an extremely durable waterproof lacquer coating that adheres tightly to the cloth." A special anti-halation back coating is applied to the cloth to give a high degree of image-resolution, thus preventing line-spread. The cloth is obtainable with either a contact-speed, or a projection-speed emulsion. The contact emulsion is orthochromatic; the projection emulsion is blue-sensitive, so that the cloth can be processed safely with higher safe-light intensity than is conventional with projection-speed materials.

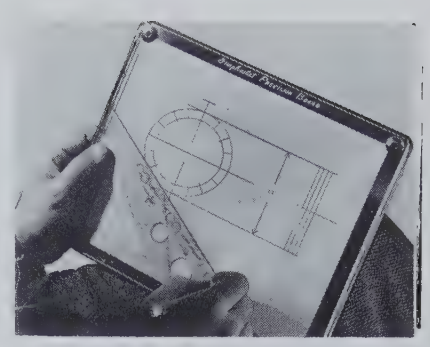


Technical Fountain Pen

A new drafting instrument for drawing, ruling and lettering provides interchangeable point sections for seven different line widths in a single holder. The Rapidograph Technical Fountain Pen (No. 3065), recently announced by Koh-I-Noor Pencil Co., Bloomsbury, N. J., allows the use of all types of drawing, regular and acetate inks. Each point section of the new instrument has its own refillable translucent plastics ink cartridge. Interchange of points is said to be both quick and neat. Each point section is numbered and color-coded for identification of line width.

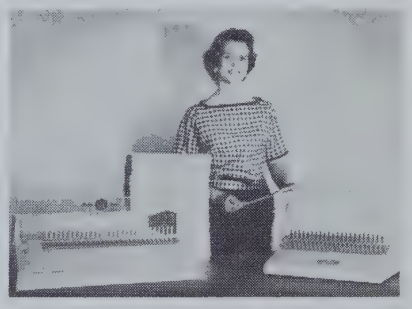
Small Adding Machine

A miniature automatic adding machine, requiring no tape and no electric current, has recently been put on the market. Called the Pico, the portable, hand-operated machine is being manufactured by Tavella Sales Co., Cliffside Park, N. J.



Small Drawing Board

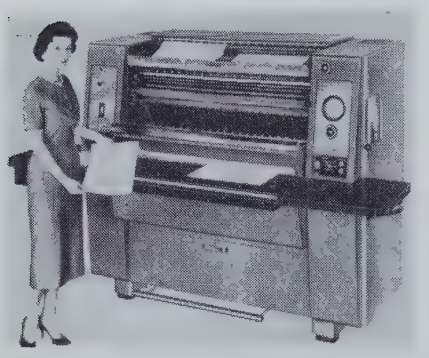
Polystyrene plastics drawing boards measuring 9¾ by 12¼ inches have been developed for use by travelling engineers and architects. The tough transparent boards, weighing less than eight ounces, are produced by Graphostat Co., 110 Eaton Pl., East Orange, N. J. Four corner clamps are provided for attaching 8½-by-11-inch sheets of paper; these clamps are recessed so that a triangle or ruler can ride freely over them. Two retractable metal straightedges — horizontal and vertical — come with the board, along with two calibrated triangles.



Electric Binding Machine

An all-electric plastics binding machine, said to cut binding time and to reduce operator fatigue, has been introduced by General Binding Corp., 1101 Skokie Highway, Northbrook, Ill. Designated as GBC Model 16 EB Electro-Binder, the desk-top unit reportedly binds books of any size, any length and any thickness from 3/16-inch to 2-inches. A toe-touch control opens the plastics binding; the operator inserts the material and another touch of the toe closes the binding, completing the operation. Pages are said to turn easily and to need no reinforcement to retain their durability.

New Products (continued)



Diazotype Copying Machine

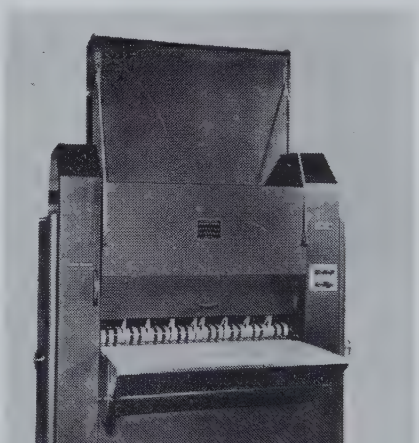
Large-scale black-on-white reproduction of engineering and architectural prints is said to be accomplished with a minimum of operator fatigue on a new high-speed diazotype whiteprint machine. Designated as Copyflex Model 675, the unit has been developed by Charles Bruning Co., Inc., Mount Prospect, Ill. The electrically operated unit features vacuum ports in the feedboard for convenience in handling flat and roll stock, power-driven height adjustment to suit operator's height and complete filtration of air to the developer section. The unit has a full 46-inch printing aperture which takes both sheets and roll stock up to 42 inches wide by any length. Mechanical speed is up to 75 linear feet per minute. Positive print development is said to be assured on all types of materials, regardless of machine operating speed.

Storage Cabinets

Two new standard height storage cabinets for filing and protecting rolled tracings and prints have been announced. Manufactured by Stacor Equipment Co., 295 Emmet St., Newark 5, N. J., the cabinets will intermember with any stack or rack of present Staktube models. The addition is in the shorter length or "depth" of the cabinet. One of the new sizes (No. TU-81), designed to carry 36 tubes of the normal "small" size for individual prints, measures 19½ inches in depth; it contains 2¼ inch ID storage tubes, 18 inches deep. The 9-tube model (No. TU - 981) is also 19½ inches deep; the ID of individual tubes is 4⅜ inches.

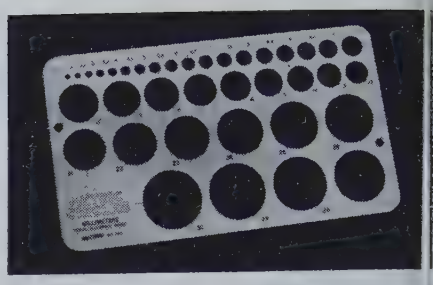
Marking Pencil

An all-purpose marking pencil, said to perform equally well on paper, metal, photo film, glossy sheets and glass is now available in this country. Made in Germany, the Mars-Omnichrom is being imported by J. S. Staedtler, Inc., 945 DiCarolis Court, Hackensack, N. J. The new marking pencil reportedly writes as small and fine as an ordinary lead pencil but can also be used for heavy notations. It can be sharpened in an ordinary pencil sharpener without clogging the cutters. Markings wipe off with a damp cloth. The Mars - Omnichrom pencil is available in seven colors.



Improved Reducing Camera

Redesign of the continuous-flow reducing camera has been completed by its co-inventor, Carroll B. Collins of Pittsburgh, Pa. The new Neoflow Reducing Camera, like the earlier versions, operates on a continuous-flow principle and utilizes the method of reflex photocopying. However, certain improvements have been made in its optical and illumination systems and the structure of the camera has been modified in a number of ways to eliminate vibration. Peerless Photo Products, Inc., Shoreham, L. I., N. Y., handles the national distribution of this equipment. In general, the design has been made more flexible than ever before, with provision for adapting the camera so that any desired reduction ratio can be built into it.



Metric Circles Template

Thirty-seven circles from 2 to 30 millimeters in diameter are included on a 4-by-7-inch template designed for draftsmen using the metric system as a basis for measurement. Recently announced by Rapidesign, Inc., P.O. Box 429, Burbank, Calif., the No. 240 Metric Circle Template is made of 0.030 - inch matte - finish plastics. Circles from 2 to 10 mm. are in increments of 0.5 mm. and from 11 to 30 mm. in increments of 1 mm.

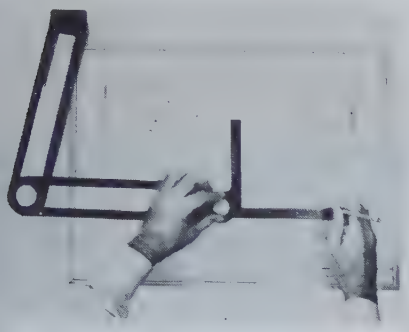
Improved Lead Pencil

An instrument said to write as black as a soft pencil, to be as strong as a hard pencil, to make many carbon copies and to reproduce clearly on office duplicating machines has been announced by Venus Pen & Pencil Corp., Lewisburg, Tenn. Called the Venus 3500, the new pencil is said to need less sharpening than previous pencils and to be up to 50 per cent stronger.

Dimension Calculator

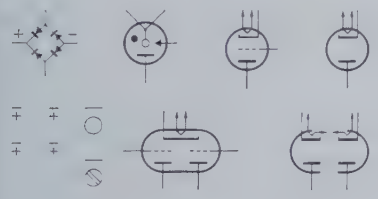
Automatic addition and subtraction of dimensions expressed in feet, inches and fractions as low as eighths, is said to be accomplished by use of a new adding machine. Called Addfeet, the unit is manufactured in West Germany by Addiator Rechenmaschinenfabrik and distributed in the U.S.A. by Alexander Drafting Co., 640-642 North Chester Ave., Pasadena, Calif. The machine has separate addition and subtraction columns with clear disposition of figures. It is said to automatically convert inches into feet and feet into inches. The unit measures 6½ by 2⅜ inches and weighs three ounces.

New Products (continued)



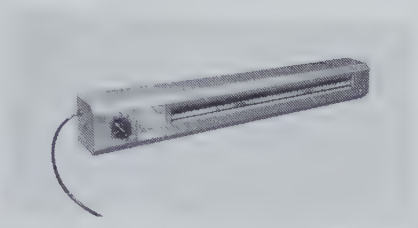
Portable Drafting Machine

A drafting machine said to fold like a jackknife to fit into a briefcase has been designed as a personal portable instrument for drafting and sketching. Called Draftette Senior, it is manufactured by David Miller & Associates, Box 572, Beverly Hills, Calif. Constructed of black anodized aluminum, the instrument has a one-piece 6-by-9-inch interchangeable scale with specially processed numerals that cannot rub off. It is divided into 16ths or 10/50ths, with a 360° protractor. It covers 400 square inches of drawing surface.



Electronic Symbols

Dry adhesive pressure-applied electronic symbols on clear acetate are now available to the electronic industry. Developed by Tech - Tac, Inc., 727 West Seventh St., Los Angeles 17, Calif., the symbols are said to cover 95 per cent of all electronic engineering needs. All standard symbols, including 635 tubes, plus transistors, etc., to fit JAN, MIL and ASA requirements are available. The complete system consists of 165 numbered paperbacked acetate sheets on each of which are an average of 48 symbols. In use, individual symbols are removed from the sheet with the aid of a pointed stylus. The symbol is lifted away from the backing sheet and positioned on the drawing and burnished firmly in place.



Portable Diazo Machine

The development of a small rotary whiteprint machine has been announced by Grico, Inc., 1279 Munroe Falls Ave., Cuyahoga Falls, Ohio. Called the Satellite, the unit weighs less than 30 pounds and can be wall-mounted or placed on a desk or table. It may be plugged into any 115-volt convenience outlet. It produces white prints of any length and in widths up to 30 inches, from any translucent original. Standard diazo - sensitized papers may be used in the unit. A front dial with selective speed variations permits exposure control.

New Literature

Blue Print Racks Brochure describes a series of racks which suspend prints vertically from clamp - action steel channel tracks. It may be obtained without obligation from Momar Industries, 4323 W. 32nd St., Chicago 23, Ill. Open - end, compartmented filing cases for use on top of the racks are also covered.

Hand Tools Catalog, describing knives, blades and a variety of special small tools, is available free of charge from Handicraft Tools, Inc., Division of X-acto, Inc., Long Island City 1, N. Y. Many of these products feature replaceable blades and bits. They are useful in engineering departments, drafting rooms, laboratories, workshops, etc.

Drafting Equipment Catalog, No. GC-59, showing blueprint filing units, roll files, auxiliary cabinets, drafting tables, counter - balances, drawing tables, reference tables, dust covers, straightedges and other accessories, may be obtained by writing to Stacor Equipment Co., 295 Emmet St., Newark, N. J. The catalog is fully illustrated and includes complete ordering information.

Blueprint Filing Equipment Catalog, No. 4029 (AIA File 35-H-32) may be obtained on request from Frederick Post Co., Englewood, N. J. Both vertical and roll filing equipment is described and illustrated.

Fire-Safe Storage Catalog, No. SC688, Rev. 1, may be requested from Remington Rand, Inc., 315 Fourth Ave., New York 10, N. Y. A variety of certified fire- and impact-proof storage units for drawings and other records are shown. Catalog numbers and dimensions are given.

Whiteprinting Machine Brochure, titled *The Revolute Comet Automatic Whiteprinting Machine,* describing a dry diazo developer with a production speed of 75 fpm, is available on request to Paragon-Revolute Corp., 77 South Ave., Rochester 4, N. Y. The brochure is fully illustrated, design features are clearly presented and machine specifications are given.

Directory, American Council of Independent Laboratories, Inc., listing 500 services performed by member laboratories in testing, inspection and applied research, is available without charge on application to Executive Secretary, ACIL, 4302 East - West Highway, Washington 14, D. C. The current directory is the 7th edition, a hard-bound, 100 page publication.

Plastic Lamination Brochure, entitled *A Guide to Graphic Laminations,* may be obtained by request to Willson Camera Co., Inc., 1395 Lawrence Rd., Havertown, Pa. The brochure is illustrated to show a number of different products which can be protected and beautified by plastics laminating. Technical manuals, schematics, promotional and advertising printing, and color transparencies are among the items that fall within this category.

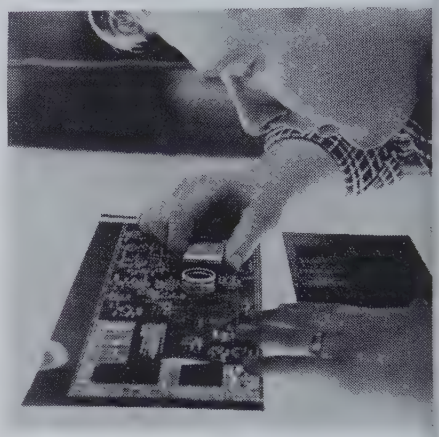
Drawing Fountain Pen Brochure, outlining the features of the Alvin Techagraph pen is offered by Alvin and Company, Windsor, Conn. Six interchangeable nibs, each color keyed, permit fast interchange to obtain sharp, uniform lines of varying widths.

Microfilm Drawing Systems Catalog describing the Recordak 35 mm. film unitized engineering drawing system may be obtained from Recordak Corp. (Subsidiary of Eastman Kodak Co.), 415 Madison Ave., New York 17, N. Y. The catalog contains samples of aperture cards with original camera film negative, intermediate printing film negative, release film negative and diazo negative. Also presented are three programs for handling engineering drawings and related data; these are illustrated with flow charts. Reproductions made from the 35 mm. film transparencies are included as fold-out pages of opaque and translucent projection papers.

Lettering Instrument Catalog showing the latest type faces and accessories is available from Varigraph Co., Madison 1, Wis. The Varigraph Lettering Instrument's flexibility in producing condensed, extended, shadowed, outlined or solid letters, and reverse letters is described.

(CAMERA, *Cont. from page* 19)

The figures above include savings only on paper and folding. Added to this are the savings realized from smaller filing space, shorter handling and distribution time, and easier reading and reference to the drawings.



CAREFUL inspection is made of the six-to-one size negative for clarity.

It was because of the Yard's drafting practice that only 50 per cent of the drawings were reduced in 1958. Fractions, for example, were not sufficiently clear. However, drafting practice has steadily improved and during months of January and February of 1959, 78 per cent of all the drawings were reduced, resulting in savings of $15,000 for those two months alone.

Reducing cameras have also been installed at the Philadelphia and Portsmouth (N. H.) Naval Shipyards. The U. S. Navy appears to be convinced that substantial savings can be effected by the use of reduced-size prints for modern shipbuilding operations.

OPERATOR supervises the making of diazo prints from reduced positives.

GRAPHIC SCIENCE IS FOR SOME—NOT ALL

IN ORDER to receive subsequent copies of GRAPHIC SCIENCE, the Questionnaire below must be completed and returned to: Editor, GRAPHIC SCIENCE, 103 Park Avenue, New York 17, New York. A facsimile can be filled out and mailed if you would like to keep this issue intact. All Questionnaires will be acknowledged.

Your free subscription to GRAPHIC SCIENCE will be continued if your job involves: (1) The supervision of draftsmen or a drafting department. (2) Supervision of reproduction or drawing-filing personnel or departments. (3) Supervision of technical illustrators or technical photographers. (4) Teaching of engineering drawing or graphics. If you do not qualify and wish to continue receiving GRAPHIC SCIENCE, the subscription rate is $8.00 per year in the United States, $9.00 per year to Canada; $10.00 to other countries.

Your free subscription will be discontinued if the questions below are not answered. The information you supply here will never be divulged. In coming issues, however, we will summarize the data received, reporting results for your own information.

May we hear from you shortly?

Name: _____

Title: _____

Company: _____

Address: _____

_____

_____

Company Product or Function: _____

_____

_____

Your job function: _____

_____

_____

_____

Number of personnel in your department:

_____ Draftsmen

_____ Designers

_____ Technical Illustrators

_____ Reproduction

_____ Checkers

_____ Others

I've been working in my present job for _____ years.

Check one:

_____ I'm qualified to receive GRAPHIC SCIENCE free. Continue my subscription.

_____ Take me off your list.

_____ I don't think I'm qualified to receive GRAPHIC SCIENCE free, but I'd like to subscribe.
_____ Bill me. _____ Check enclosed.

There are other personnel in my firm who should receive GRAPHIC SCIENCE. Their names, titles, and addresses are as follows:

_____

_____

_____

(You may attach a second sheet, if the space here is not adequate.)

Comments? _____

_____

_____

I'm interested in writing for GRAPHIC SCIENCE:

_____ Yes _____ No

Signed _____

Letters

(*Continued from page 4*)

Sirs:

Congratulations! The first issue of "GS" was a very good one. . . . Would it be possible to send us a couple more copies? By the way, your cover design was simple but very well done and effective.

JACK BOLGER

The Bolger Studios
Sparta, New Jersey

Briefer Comments

Sirs:

Why not have a series of articles on drawing, simple rendering, and reproduction techniques?

* * *

Sirs:

Your magazine is surely a step forward in the recognition of the professional field of drafting.

* * *

Sirs:

Future issues should include articles on new developments and trends in teaching engineering graphics.

* * *

Sirs:

Give us a survey on simplified drafting.

* * *

I would like to see more reproduction information. (Diazo and microfilm.)

* * *

Sirs:

Give more information of printed circuit masters; also die cast drawings—parts lists.

* * *

Sirs:

Suggest articles on getting the most from inexperienced draftsmen.

* * *

Sirs:

I've been waiting for 31 years for a good trade journal of this type.

* * *

Sirs:

I love the first article by Wladaver. It should be read by all deans of engineering schools.

* * *

Sirs:

Would like to see articles on jobs, salaries, and other administrative subjects.

The Editor's Board

Chief Draftsmen, Cabs and Quarterbacks

MADISON, WISCONSIN was damp, turning cold when we arrived last week at the invitation of Robert A. Ratner, "in charge" as the announcing brochure has it, of the Effective Drafting Management program of the University of Wisconsin's Engineering Institutes.

Two days later, when we left, the air was really cold, and football noises were being made in the streets. We learned that Purdue was coming to town for Saturday's game and scurried from the University Center Building frantically searching for a cab. In Madison they are not easy to come by.

One driver shook his head, driving on; looking for somebody important, we thought. Another cab we thought we had caught, parked. We opened the back door, expecting to get in. "You on the Wisconsin team?" the driver turned toward us. We shook our editorial head pensively.

THIS IS OUR seventh Drafting Institute," Mr. Ratner explained, when we buttonholed *him* the morning of the 8th at the first of the two-day sessions. "We've been surprised at the amount of interest. The men seem to like the programs. Many come back for a second or third time, a few even paying their own way."

"See," he showed us a roster, "good progressive firms send their top drafting supervisors." We nodded. "I've got to rush now and MC this thing." And so he did, very effectively too, we thought, listening.

RATNER TOOK US ASIDE later. "We have a pretty small group attending here, almost an informal draftsman's society. We try to keep it that way. I don't think a big convention is what they really want; you know, a speaker on a big platform and a couple of thousand people in one room. There, when they go they don't really get to know anyone." We nodded. "Here," he explained, "I try to help the men get acquainted with each other." We looked down, a big name card bristling from our lapel.

"Actually, these chief draftsmen and supervisors have a great deal they can learn from their counterparts in other companys. We try to give them an atmosphere in which they can share their problems."

"A couple of years ago we had three or four seminars on simplified drafting. I guess that's really how we got started. After we beat that subject into the ground we discovered a great deal of interest in management, and management problems." That explained the program: Training of Engineers and Draftsmen in Process Work; Estimating and Cost Control in a Drafting Department; Work Sampling to Predict Performance; Improving Your Managerial Effectiveness; Operations and Procedures for Engineering and Drafting Supervisors.

"More than half these men are graduate engineers" he continued. They're in charge of from three to upwards of 150 draftsmen, many of whom are engineers. And management is their single biggest problem. Getting maximum performance, keeping up morale." We nodded. He paused.

"What do you think of this?" we asked, handing him a copy of a new magazine we happened to have with us. *He* nodded.

OUT AT THE MADISON AIRPORT, when we finally made it, we waited for our call. "Passengers for Northwest Orient Airline's Flight 528 now boarding at Gate 3," this from the squawk box. We headed for the nearest gate, started to board the plane. Someone grabbed us by the shoulder. "You on the *Purdue* team?"

We winced.

The Book Shelf

by Wilfred J. Thompson

INDUSTRIAL BUILDING DETAILS, 2nd ed., by Duane F. Roycraft, Architect. 356 pages, 8¾ by 11⅝ inches, over 1,500 line illustrations, F. W. Dodge Corporation ($12.75)

SOME YEARS AGO, a chief draftsman in the office of a prominent architect paused at the board of a young draftsman struggling with a full-size detail of a double-hung window.

"Ye Gods!" the C.D. thundered, "Why must we go through this for every job we do? Can't we solve a thing like this once and use it on all jobs?"

Obviously the young draftsman, confronted with a particular detail problem for the first time, was unknowingly retracing paths covered by others before him. The others, however, having solved their problems had moved on, leaving no organized record of their efforts.

Happily, Detroit architect Duane F. Roycraft, author of *Industrial Building Details,* had the foresight to record certain details which were of most use in his work. Eventually his collection became known and a demand from friends for copies of his details grew to the point where he published them privately. The current edition is a revised and expanded extension of the first.

Separated into seventeen well indexed chapters, a great variety of working details are presented in clear "drafting room" type drawings. These are comprehensive working details of such prosaic necessities as catch basins and manholes, hatch covers and frames, expansion joints, flashing, roofs and parapets, louvers and a multitude of similar items that in the past have caused much head-scratching in architectural drafting rooms.

The details make no attempt to present aesthetic considerations. This is properly left on the board of the individual designer who, however, should be immeasurably aided by seeing clearly what he should keep in mind as he yields his 4B pencil.

The introduction to each chapter is well conceived in that it makes clear the purpose of the details and aids in their proper selection. Features or operating problems that may not be obvious in the drawings themselves are explained. In addition to the illustrations, a handy list of abbreviations and a key to material indication are included, together with a complete index.

It is this writer's opinion that architects, engineers and others engaged in the design and construction of industrial buildings—or other types, for that matter—would benefit by having a copy of *Industrial Building Details* on their reference shelves.

Have you seen

the Questionnaire

on page 33?

REDUCE 60 TO 1—*get both data and drawing on microfilm*

THE USE of photographic systems for storing, then retrieving information is growing quite common, but the potentials of these are only beginning to be realized. Among the systems whose usefulness extends into the area of graphics, drawing handling, and storage is one announced last year by Recordak Corporation, a division of Eastman Kodak.

The Kodak Minicard system, now in use by the U.S. Air Force in the Pentagon in Washington, was produced under a contract placed with Kodak by Rome Air Development Center, Griffiss Air Force Base, Rome, N. Y. The system is under continuing development and is not generally available until further government commitments are fulfilled, according to Kodak.

Key to the system is a miniature piece of microfilm 16 by 32mm, or about the size of a postage stamp. In lieu of punched holes the Minicard film record utilizes clear and opaque areas for binary code, exposed as square dots in the film emulsion. The drawings or charts are recorded on the film, typically to the right of the area reserved for code storage.

Despite its small size, each film record may contain as many as twelve legal-size documents, whether charts, graphs, or drawings. This has been made possible, according to Kodak engineers, by the unusually high ratio of reduction, 60 to 1, achieved by a precision combination of lenses, film, and lighting.

A fully-contained, Minicard system consists of a number of major and accessory pieces of equipment including several manufactured by The Magnavox Company, whose engineers cooperated with those from Kodak in developing certain phases of the system.

Advertisers Index

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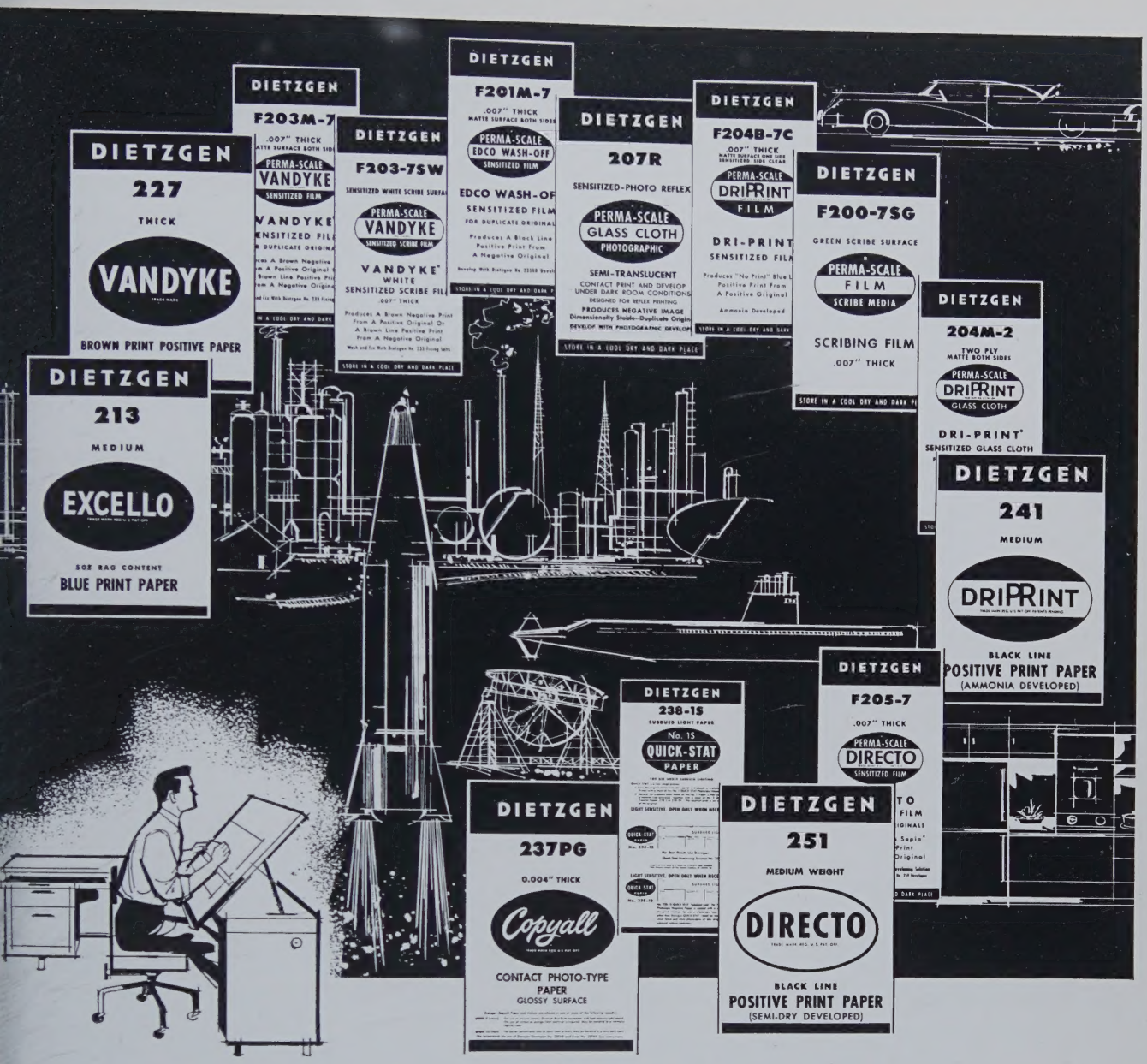

the mechanics of modern miracles

lodern engineering and production iracles could never have been accom- ished were it not for man's ability to educe his ideas to visual form. It is only ecause he can transmit his mental im- ges on paper that such complexities as pace vehicles and other of today's tech- cal wonders have evolved.

In every industrial manufacturing stablishment, drafting and reproduction roblems are similar, yet different. Time nd labor saving requirements are basic all, but production requirements and ssemination problems vary across wide nges. Requirements, in terms of qual- and quantity of drawings, to guide eographically dispersed engineers, de- gners and craftsmen in the creation of b-assemblies or components of the ished product will vary considerably en in identical industries. This is true because differences exist in individual organizations and methods of operation.

It is possible, therefore, to prescribe a system and the media to be used only when all factors of economy, production, geographical distribution, time and labor savings have been considered, and evaluated in relation to each industry's requirements.

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